Mr. Philemon Sheshelwa boustifully showing his technology application success. (Gadifrey Baraba (DED -Bukoba, Box 491, Bukoba))

Contour bund combined with lemon grass, pineaples. grass mulch and manure in banana beans intercrop production. (Tanzania, United Republic of)

Fanya juu, fanya chini yenye michaichai, nanasi juu ya tuta. katika shamba la migomba.

DESCRIPTION

Is the excavation of a furrow along the contour line, soil embankment on either side, planting lemon grass alternating with pineapples along the bund combined with application of grass mulch, Farm Yard Manure in banana bean inter-crop production.

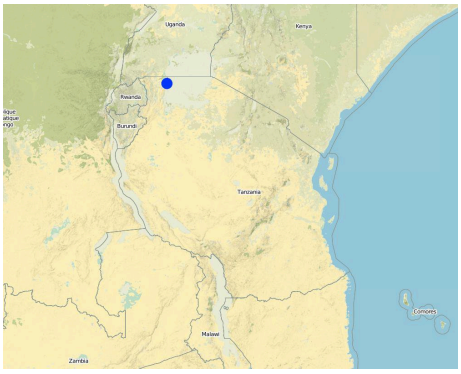
Contour band combined with lemon grass, pineapples, Hyperrhamia rufa mulch and manure technology in the banana production is the excavation of a 60cm deep by 60cm wide furrow and formation of soil embankment on upper side (at smaller slope) and lower side (at the greater slope) of the furrow to improve soil water infiltration; then planting on it with lemon grass and pineapples to stabilize soil embankment combined with spreading of a 15cm thickness grass mulch across the slope while 36kg of farm yard manure applied in a furrow measured 30cm deep by 60cm wide facing the grand daughter banana sucker at the distance of 60cm from the stool. Trushline is applied to complement grass mulch while lemon grass and pineapples are harvested routinely for sale.The technology is applied on perennial cropland characterised with sub humid in tropical climatic zone. The main biophysical features are gentle slope, clay loam soil with shallow depth. The technology done manually using hand hoes to cultivate land in a mixed (subsistence and commercial) production mode. To implement the technology, it costs US$ 220.00 for establishment and US$ 2,222.65 for maintenance costs. The technology was introduced in late 2012 by TAMP –Kagera using FFS methodology.

Purpose of the Technology: The major purpose of the technology is prevented land degradation in 50 ha while increased 10% of crop and livestock production to contribute on food security and improve livelihood with sustainable land management. This purpose should be achieved by performing the following main technical functions: control of dispersed runoff, increase in organic matter, increase in nutrient availability (supply, recycling,...), increase of infiltration and increase / maintain water stored in soil.

Establishment / maintenance activities and inputs: The establishment activities includes:- First is identification and demarcation of contour lines done manually using the A-frame simple made tool, the activity normally done in May. Second is construction of contour bund along the identified and demarcated contour done manually using cheasle hand hoes, fork hand hoes, spades and mattock, this is done in early June. Third is Planting lemon grass and pineapples along the contour bund done manually by spacing 30cm plant to plant (grass lemon) while pineapples are planted at 5m alternating with lemon grass; this is done in early September.
The maintenance activities included:- First is farm weeding done manually using a simple made weeding tool (kahosho); this is done twice (January and June to August). Second is Farm yard manures application done manually using baskets, spades and fork hand hoes; this is done in July. Third is grass mulch application done manually by spreading dry Hyperrhamia rufa across the slope with a thickness of 15cm to cover space between the bunds planted with bananas; this is done in late September. Fourth is desukering and detrushing of banana stools done manually using machete, local made tools (kihosho and rwabyo); this is done twice (early March and early October). Then, harvesting bananas, lemon grass and pineapples according to market requirements. Last is furrow cleaning done manually by removing soil sediments and place them on the bund side using spades; this is done twice per year at the end of each rain seasons (May and December).

Natural / human environment: The contour bund embanked with lemon grass and pineapples technology is tolerant to seasonal rainfall decrease and droughts / dry spells. However the technology is sensitive to climatic seasonal rainfall increase, heavy rainfall events (intensities and amount). In case of climatic sensitivity, the technology should be modified with planting of perennial species having strong/ tough root system such as Pinesetum purperim and Vetiva spps to stabilize soil embankment. Furthermore the construction of spillways to drain-out the

LOCATION



Location: Bukoba Diatrict council, Kagera region, Tanzania, United Republic of

No. of Technology sites analysed:

Geo-reference of selected sites
- 31.81872, -1.32913

Spread of the Technology: evenly spread over an area (approx. 0.1-1 km2)

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

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

excess water and reseve them in the ditches to be used in the farms later. This technology is applied by Individual / household categorized as small scale common / average land users, with importance of men and women participating equally. The land is owned individually, not titled. The Water use rights is open access (unorganized). The relative level of wealth falls under three categories; the rich, which represents 4% of the land users; owning 32% of the total area; the average, which represents 64% of the land users owning 64% of the total area and the poor, which represents 32% of the land users owning 4% of the total area. Individuals who applied the technology should value the off-farm income as 10%. The market oriented is mixed (subsistence and commercial).

Mr. Philemon Sheshelwa decided and implemented Fanya juu fanya chini in his agroforet field prone to soil erosion, declined soil fertility and moisture stresses. (Godfrey Baraba (DED -Bukoba, Box 491, Bukoba.))

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] 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
- [x] 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 - potatoes, lemon grass
- Perennial (non-woody) cropping: banana/plantain/abaca, pineapple
- Tree and shrub cropping: coffee, open grown

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)

SLM group

- agroforestry
- improved ground/ vegetation cover
- irrigation management (incl. water supply, drainage)

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A7: Others

vegetative measures - V5: Others

structural measures - S2: Bunds, banks, S4: Level ditches, pits

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **Tanzanain shiling**
- Exchange rate (to USD): 1 USD = 1700.0 Tanzanain shiling
- Average wage cost of hired labour per day: 1.76

Most important factors affecting the costs

The most determinate factor affecting the cost is Farm Yard manures US$ 441.18 which is the maintenance cost especially for soil nutrient maintenance.

Establishment activities

1. To plant lemon grass seedlings (Timing/ frequency: march & september)
2. To plant pineapples seedlings (Timing/ frequency: March & SEptember)
3. To dermacate the level mark using a Frame. (Timing/ frequency: January and June)
4. To dig and excavate soils from the ditch (Timing/ frequency: February and August)
5. To spread the excavated soils along the ditch on the upper side. (Timing/ frequency: February and August)
6. Purchase of hand hues (Timing/ frequency: None)
7. Purchase of machete (Timing/ frequency: None)
8. Purchase of kohosho (Timing/ frequency: None)
9. Purchase of sickles (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Tanzanain shiling)	Total costs per input (Tanzanain shiling)	% of costs borne by land users
Labour					
Labour	ha	1.0	258.76	258.76	100.0
Equipment					
Tools	ha	1.0	17.06	17.06	100.0
Plant material					
Seedlings	ha	1.0	263.63	263.63	100.0
Fertilizers and biocides					
Compost/manure	ha	1.0	864.35	864.35	
Total costs for establishment of the Technology				**1'403.8**	
Total costs for establishment of the Technology in USD				*0.83*	

Maintenance activities

1. To weed by hand with small kihosho (Timing/ frequency: Late Jan & July)
2. To ditrush and desucker bananas with huge Kihosho (Timing/ frequency: Feb & August)
3. To plant beans (Timing/ frequency: March & September)
4. To spread mulch alternating with trashes between the bunds. (Timing/ frequency: late March and September)
5. To apply manure selectively on the spoted banana stools (Timing/ frequency: february & August)
6. To harvest and market lemon grass (Timing/ frequency: monthly)
7. To harvest pineapples and market them. (Timing/ frequency: routrrnly)
8. To remove sediments from the ditches (Timing/ frequency: atwice before rain season.)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Tanzanain shiling)	Total costs per input (Tanzanain shiling)	% of costs borne by land users
Labour					
Labour	ha	1.0	264.71	264.71	100.0
Plant material					
seeds	ha	1.0	117.65	117.65	100.0
Other					
Hyperrhamia rufa	ha	1.0	180.15	180.15	
Total costs for maintenance of the Technology				**562.51**	
Total costs for maintenance of the Technology in USD				*0.33*	

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 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

Agro-climatic zone

- ☐ humid
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

Long rains (September To December) and short rains (March t0 May). Dry periods is 155 days. Length of growing period is 210 days. Thermal climate class: tropics. The average temperature is 18°C.

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

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [x] 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.
- [x] 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)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] 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%)
- [ ] 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)
- [ ] good drinking water
- [x] 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
- [ ] average
- [ ] 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
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [x] 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)
- [ ] 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

IMPACTS

Socio-economic impacts

Crop production

decreased ✓ increased

banana bunch from 25 to 35kgs, beans from 0kg to ...,

risk of production failure	increased ✓ decreased	lemon grass from 0kg to ...kg and pineaples from 0 to ..kg
expenses on agricultural inputs	increased ✓ decreased	Quantity before SLM: 1 Quantity after SLM: 2 cost of grass mulch, manures, pineaples and lemon grasses
farm income	decreased ✓ increased	sales of suplimentary products (lemon grass and pineaples)
workload	increased ✓ decreased	Quantity before SLM: 1 Quantity after SLM: 2 Reduced weeding frequency from two to once. Youth and woman labour shift to hired labourers for grass mulch.

Socio-cultural impacts

food security/ self-sufficiency	reduced ✓ improved	Quantity before SLM: 0 Quantity after SLM: 23 HH Sales of lemon and pineaples should ensure purchasing power of food out of the farms.
SLM/ land degradation knowledge	reduced ✓ improved	Quantity before SLM: 0 Quantity after SLM: 13 members The ditches trape water and enhance infiltration, the bunds alignments practices .
Improved livelihoods and human well-being	decreased ✓ improved	Farmers applying the technology experienced production increase consequently increased income. The increased income should be spent on school fees and health costs. The community as a whole did achieved food security in the sense that, they can enjoy employment opportunities in the farms required to collect grass mulch for food payments from their neighbors.

Ecological impacts

surface runoff	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 1 Building bunds catches the sedments to level the surface and consecuntly spread the water instead of down sloping.
evaporation	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 2 Mulch grasses should imped sun rays as well as retarding evaporation from the soils.
soil moisture	decreased ✓ increased	Quantity before SLM: 0 Quantity after SLM: 1 Mulching should minimise the sunlight energy as well as poor conduction of heat to reach the soil surface.
soil cover	reduced ✓ improved	Quantity before SLM: 0 Quantity after SLM: 1 Mulsh grasses impends the sun rays intensit and rain drops.
soil loss	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 1 Erosions formelly transfered soils from uper oints to lower points.
nutrient cycling/ recharge	decreased ✓ increased	Quantity before SLM: 0 Quantity after SLM: 2 Manure aplication increased nitrogen into the soils.
soil organic matter/ below ground C	decreased ✓ increased	Quantity before SLM: 0 Quantity after SLM: 2 Decayed grass mulch, banana trushes and othe farm residues.

Off-site impacts

damage on public/ private infrastructure	increased ✓ reduced	Quantity before SLM: 0 Quantity after SLM: 1 Runoff from uphill field

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative ✓ very positive	

Long-term returns very negative ✓ very positive

Benefits compared with maintenance costs

Short-term returns very negative ✓ very positive

Long-term returns very negative ✓ very positive

The short term returns (annual farm income) is slightly negative compared with establishment costs; while the long term returns (cumulated increments) is difficult to comment at this (juvenile) stage. The short term return compared with maintenance costs is positive; while the long term return is still early to give any comments.

CLIMATE CHANGE

Gradual climate change

annual temperature increase not well at all very well Answer: not known

Climate-related extremes (disasters)

local rainstorm not well at all ✓ very well

drought not well at all ✓ very well

general (river) flood 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
- [x] 1-10%
- 11-50%
- > 50%

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%

Number of households and/ or area covered

36 households and 100% of the area covered

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

- Efficient use of rain water in crop land production.
- Reduced workload for farm maintenance especially weeding and general farm cleanliness.
- Increased crop productivity to ensure food security and general livelihoods.
- Easy and low cost of establishment, especially use of soils as readily available materials.

Strengths: compiler's or other key resource person's view

- Availability of grass mulch in the communal lands.
- Efficient utilization of land, especially planting lemon grass and pineaple are of multipurpose. e.i soil stabilization and commecial produce.
- Low establishment costs i.e. US$ 187 mainly as medium labor costs to excavate the furrow manually, which can be affordable to average farmers using household members.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Still BXW can infest well nourished and cleaned banana in the farms were technology is applied. To abide on the cardinal rules of BXW contol.
- High costs of manures.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- The technology can be applied on the flat to genlte slope, otherwise stones and other materials should be applied to strengthen the band. Use materials with tough roots such as vetiva grass and elephant grass to stabilize soil embankments.
- The agronomic costs has high costs especially soil nutrient which requires manures. More emphasis on vegetative soil cover plants, especially leguminous plants with ability to fix nitrogen while trash-lines should increase biomass and contribute to organic matters.
- It is not worth to reduces soil erosion when you think of mulch grass costs i.e. US$ 441.18 per hector. Use better crop cover such as muccuna spps

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1200/

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n.a.

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