Mr. Kalibatano accompanied by his son well coming the private service provider who visited the where the technology is applied. (Godfrey Baraba (DED -Bukoba, Box 491, Bukoba.))

Grass mulch combined with cow dung, Triple Supper Phosphate and Calcium Ammonium Nitrate in maize production. (Tanzania, United Republic of)

Matandazo ya nyasi katika kilimo cha mahindi yaliyolishwa mbloea.

DESCRIPTION

Is the spread of dry Hyperrhamia rufa across the slope combined with manures, Calcium Ammonia Nitrate and Triple Supper Phosphate in maize production.

The spread of dry Hyperrhamia rufa 15cm thickness across the slope combined with manures, TSP and CAN in maize production technology is applied on annual cropland for reduced declining soil fertility, reduced soil erosion and improved soil moisture content in the sustainable land agro-ecosystem management. The activities to implement the technology includes to slush bushes and cut grasses using sickles , to cultivate the land using hand hoes, to measure spacing demarcate and dig holes using hand hoes, to mix manure, soils and TSP in a 5cm depth hole using hands, to spread grass mulch using hands, to plant maize seeds using hand hoes, to apply CAN at week four after planting using hands, to weed the whole field using hands, to apply a mixture of ashes and pepper on the tip, closed tip leaf to control maize stock-bores and to harvest and trush using hands

This technology is applied on annual cropland using agronomic measures in the sub humid climatic zone. The slope category of that land is gentle, characterized of loam sandy soil textures with medium soil depth.

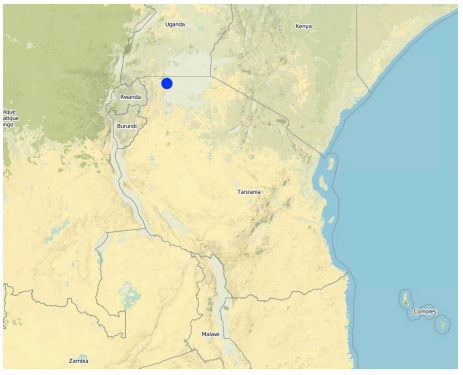
The technology is applied by Individual / household, Small scale land users, common / average land users, men and women. The Land ownership is individual, not titled and Land use rights is individual as well. Water use rights is open access (unorganized).
The relative level of wealth categorized as, rich, which represents 20% of the land users and own 32% of the total area. Average, which represents 64% of the land users and own 64% of the total area. Poor, which represents 20% of the land users and own 4% of the total area.
The technology was introduced in 2012 by TAMP -Kagera using FFS in the community integrated catchment approach.
To implement the technology it was calculated to be US$ 57.059 for establishment and US$ 1,923.36 maintenance costs.

Purpose of the Technology: The major purpose of the technology is to prevent loss of top soil, to improve soil fertility decline and reduced organic matter content on the annual cropland with a sustainable land management to improve community livelihood.

Establishment / maintenance activities and inputs: This technology has no establishment activities as a common phenomena for all Agronomic measures. The maintenance activities of the technology includes; To slush bushes and cut grasses using sickles in Late August, To cultivate the land using hand hoes in Earl September, To measure spacing, demarcate and dig holes using hand hoes in earl September, To mix manure, soils and TSP in a 5cm deep hole using hands in mid september, To spread dry Hyperrhamia rufa using hands mid September, To plant maize seeds using hand hoes Late September, To apply CAN at week four after planting using hands in mid October, To weed the whole field twice using hands in early November and early February , To apply a mixture of ashes and pepper on the top openleaf to control maize stock-bores, To harvest and trash maize cobs using hands in Late February redy for marketing in late May.
To perform the maintenance activities the following inputs required; Labour, tools, seeds, fertilizer, biocides and compost/manure. All inputs can cost a total of US$ .....0 per hector per season.
The dry Hyperrhamia rufa mulch in the Zea maize pure stand complemented withi cow dung, TSP and CAN introduce in April 2012 by TAMP -Kagera in the Butulage catchment.

Natural / human environment: This technology is applied on the cropland type in the subhumid. The landform of this catchment is plain and footslpoes with gentle slope. It is obvious that, the land is prone to sheath erosion, soil fertility decline and reduced organic

LOCATION



Location: Bukoba D.C, Tanzania, Tanzania, United Republic of

No. of Technology sites analysed:

Geo-reference of selected sites
- 31.81791, -1.32835

Spread of the Technology: evenly spread over an area (approx. < 0.1 km2 (10 ha))

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

matter content. However, the cause of these types of land degradation includes direct (human and natural) and indirect (land use supporting system). The technology is tolerant of seasonal rainfall decrease and drought or dry spell climatic extremes. On another hand the technology is sensitive to foods where excess water will lodge and damage the maize roots.

The land ownership is individual not titled and catergorised in small scale farmers who practiced mixed production mode. The wealth of the people applying this technology can be categorized as poor, average and rich according to land ownership. The poor repents 20% of land users and own 4% of the cropland area. The average category represents 64% of the land users and own 64% of the cropland area. The rich category represents 20% of cropland users and own 32% of the cropland.

Mr. Kalibatano accompanied by his son well coming the private service provider who visited the where the technology is applied. (Godfrey Baraba (DED -Bukoba, Box 491, Bukoba.))

Mr. Kalibatano listeng site facilitator Misss. Nkuba during her routeen field vist as atraining metod, (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, vegetables, fruits
- Perennial (non-woody) cropping: banana/plantain/abaca
- Tree and shrub cropping: coffee, open grown

Number of growing seasons per year: 1

Water supply

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

Purpose related to land degradation

- [x] prevent land degradation
- [ ] 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

SLM group

- integrated soil fertility management

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

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

Most important factors affecting the costs

The most determinate factor is light labor (US$ 641.53).

Establishment activities

1. handhoes (Timing/ frequency: None)
2. machete (Timing/ frequency: None)
3. sickles (Timing/ frequency: None)
4. tape measures (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Tshs)	Total costs per input (Tshs)	% of costs borne by land users
Equipment					
Handhoes	pieces	16.0	2.94	47.04	100.0
Machete	pieces	16.0	1.17625	18.82	100.0
Sickles	pieces	16.0	0.47	7.52	100.0
tape measures	pieces	1.0	11.76	11.76	
Total costs for establishment of the Technology				**85.14**	
Total costs for establishment of the Technology in USD				*0.05*	

Maintenance activities

1. To slush bushes and cut grasses using sickles (Timing/ frequency: late august)
2. To cultivate the land using hand hoes (Timing/ frequency: early september)
3. To measure spacing demarcate and dig holes using hand hoes. (Timing/ frequency: Early September)
4. To mix manure, soils and TSP in a 5cm depth hole using hands. (Timing/ frequency: Mid September)
5. To spread grass mulch using hands. (Timing/ frequency: Mid September)
6. To plant maize seeds using hand hoes. (Timing/ frequency: Late September)
7. To apply CAN at week four after planting using hands. (Timing/ frequency: Mid October)
8. To weed the whole field using hands. (Timing/ frequency: Early Nov & Early Jan)
9. To apply a mixture of ashes and pepper on the tip closed tip leaf to control maize stock-bores. (Timing/ frequency: Mid November)
10. To harvest and trush using hands (Timing/ frequency: February)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Tshs)	Total costs per input (Tshs)	% of costs borne by land users
Labour					
Slush bushes and cut grasses using sickles	person/days	20.0	1.7645	35.29	100.0
Cultivate the land using hand hoes	person/days	66.0	1.78	117.48	
Measure spacing demarcate and dig holes using hand hoes	person/days	4.0	1.7	6.8	
Labour: Harvest and trush using hands	person/days	225.0	1.7647	397.06	
Equipment					
Polythene bags	pieces	10.0	0.588	5.88	
Plant material					
Grass mulch	bundles	1500.0	0.29412	441.18	
Seeds	kg	25.0	2.9412	73.53	
Fertilizers and biocides					
Fertilizer	kg	185.0	0.97	179.45	
Mixture of ashes and pepper	tons	18.518	0.14688	2.72	
Compost/manure	tons	18.518	29.412	544.65	
Other					
Labour: Mix manure, soils and TSP in a 5cm depth hole using hands.	person/days	12.0	1.7	20.4	
Labour: Spread grass mulch using hands.	person/days	15.0	1.76	26.4	
Labour: Plant maize seeds using hand hoes	person/days	4.0	1.7	6.8	
Labour: Apply CAN at week four after planting using hands.	person/days	8.0	1.7	13.6	
Labour: Weed the whole field using hands	person/days	6.0	2.353	14.12	
Labour: Apply a mixture of ashes and pepper on the tip closed tip leaf to control maize stock-bores.	person/days	4.0	1.7	6.8	
Total costs for maintenance of the Technology				**1'892.16**	
Total costs for maintenance of the Technology in USD				*1.11*	

NATURAL ENVIRONMENT

Average annual rainfall **Agro-climatic zone** **Specifications on climate**

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 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

- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Average annual rainfall in mm: 800.0
Long and short rains
Thermal climate class: tropics. average 21°C. Average 210 day LGP

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

Landforms
- [x] 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.
- [ ] 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
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

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

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] 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?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [ ] No

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
- [x] poor
- [x] 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
- [ ] 1-2 ha
- [x] 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
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] 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	Quantity before SLM: 1 Quantity after SLM: 3 Maize yield increased from 1t to 3t per hectors.
risk of production failure	increased ✓ decreased	
production area (new land under cultivation/ use)	decreased ✓ increased	Quantity before SLM: 0 Quantity after SLM: 1 Formelly used as farrow or rangelands can be used for maize production.
expenses on agricultural inputs	increased ✓ decreased	Quantity before SLM: 1 Quantity after SLM: 3 Mulch and manures costs
farm income	decreased ✓ increased	
workload	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 1 Weeding once insted of twice but mulching demands more labour

Socio-cultural impacts

food security/ self-sufficiency	reduced ✓ improved	Quantity before SLM: 0 Quantity after SLM: 2 Maize is food, excess can be sold to earn money, money can be used to aquire animal protein source to utilise the balanced diet.
SLM/ land degradation knowledge	reduced ✓ improved	Quantity before SLM: 0 Quantity after SLM: 1
Improved livelihoods and human well-being	decreased ✓ improved	Increased maize productivity should access market and the increased accrues empowers the household to meet financial obligations especially for health and education costs.

Ecological impacts

surface runoff	increased ✓ decreased	Quantity before SLM: 2 Quantity after SLM: 1 grass mulch
evaporation	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 1 grass mulch
soil moisture	decreased ✓ increased	Quantity before SLM: 0 Quantity after SLM: 1 grass mulch
soil cover	reduced ✓ improved	Quantity before SLM: 1 Quantity after SLM: 3 grass mulch
soil loss	increased ✓ decreased	controlled rill erosion
nutrient cycling/ recharge	decreased ✓ increased	Quantity before SLM: 1 Quantity after SLM: 3 manure, TSP & CAN.
soil organic matter/ below ground C	decreased ✓ increased	Quantity before SLM: 1 Quantity after SLM: 3 manures
biomass/ above ground C	decreased ✓ increased	Quantity before SLM: 1 Quantity after SLM: 2 trashlines

Off-site impacts

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 is slightly positive (sales of maize) compared with establishment costs (US$ 85.18) while the long term returns is not applicable in this case. The short term returns is slightly positive (increased sales of maize) compared with maintenance costs < US$ 1,476.30 (decreasing labour,mulch)

CLIMATE CHANGE

Climate-related extremes (disasters)

drought: not well at all ✓ very well

general (river) flood: not well at all ✓ very well

Other climate-related consequences

reduced growing period: 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%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- 0-10%
- 11-50%
- ☑ 51-90%
- 91-100%

Number of households and/ or area covered

26 households and 100% of the area covered

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- No

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

- It has opportunity of free grass mulch harvested from communal land.

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

- There is cumulative effects of soil organic matters as a major component of land conservation.
- The technology is best appropriate for market oriented commodities.

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

- High costs of manures and mulch discouraged to choose the technology wherever future prospective is.

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

- Increased farm inputs costs in agronomic measures tends to reduce benefits in the first instants.

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1199/

Linked SLM data
n.a.

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