Improved Kibanja cropping system

Tanzania, United Republic of - Ekibanja ekiine emikolele emirungi (Haya/Nyambo)

This is a traditional banana and coffee complex cropping system interplanted with annual crops, trees,shrubs, vegetables and other diverse plants of social economic importance.

Improved traditional multi-cropping system that combines banana and coffee as main crops planted in a specific spacing to optimize plant stands. Banana and coffee are intercropped with; 1. annuals crops: Maize, beans, yams, coco-yams;2. Vegetables: Lycoperscum esculentum, Amaranthus spp, Cucumis communis and Solanum aethopium ;3. Shrubs of social economic value. Trees (e.g Maesopsis eminii, Makhcamia lutea, Ricinus comunis, Ficus thorninghii) and shrubs (Dracaena usambarensis) are planted on the farm edge. These serve as live fence, wind breaker, source of timber, fuel wood, medicine and protect the field against erosion. To optimize farm production, application of 15cm thick mulch (grass mulch and banana prunnings), farmyard or compost manure and interplanting with soil fertility and/or soil moisture improvement trees are ensured. With problems of climate change, water harvesting ditches and trenches are constructed. Water harvesting ditches are constructed to collect water from micro catchments like roads or homestead. Sustainability of the Improved Kibanja system has always been assured through crop/livestock integration approaches.The cropping system is typical in high rainfall areas along foot slopes, valley bottoms or hilltops preferably on fertile and deep soils.
The purpose is improve soil fertility,moisture, controlling soil erosion (wind and water) and suppressing weeds in order to improve the production banana, coffee and other inter planted crops.
Establishment activities: 1. Land clearing and preparation: Slashing, uprooting tree stumps, ploughing and pitting 60cm x 90cm banana hole and 60cm x 60cm coffee (Mid June to August) using simple farm implements; 2.Farm Yard Manure application: 60 Kg per banana holes and 36 Kg per coffee hole (August to early September); 2. Planting: 308 banana suckers at 3.6m x 8m spacing, 830 coffee seedlings at 3m x 8m spacing in alternating row, edge row trees seedling at 10m spacing and 15cm spacing for shrubs e.g. Dracaena usambarensis (September to November);4. Excavation of water retention structure (after planting mainly in Novermber). Full establishment of Improved Kibanja cropping system can be attained in three years. Maintenance activities:1. Weeding:Done two times per year (mid January to February / July to augost) before planting annual crops; 2.FYM enrichment: Every after 3 years; iii. banana dethrashing and desuckering ,topping mulch, coffee pruning and harvesting (Immediately after weeding); 4. Other maintenence activities: Disease control (nematode, banana weevils, Banana Xanthamonas Wilt) and Propping (using pole to support banana plant with heavy bunches against wind); 5.Inputs: Labour, farmyard manure, propping poles, mulch; 6. Simple farm implements:Hand hoe,machete and wheel barrow.
The technology is implemented in mixed land use type under sub humid condition receiving 1000-1500mm of rains per year. A combination of soil and water improvement measures (FYM application, Mulching, water retention ditches and live fencing) complement each other to minimize risk of crop failure and hence improve production. The slope is gentle to moderate , soil depth is moderate and soil texture loam. Simple hand tools are traditional used,Land ownership is individual not titled. Application of this technology determined by high establishment and maintenence cost.

left: General view on the Kibanja cropping system: banana, coffee, grass mulch and road runoff water harvesting ditch in the centre (Photo: Jasson Rwazo)
right: Water harvestin pond (Photo: Jasson Rwazo)

Location: Tanzania
Region: Missenyi District, Kyazi Village
Technology area: 0.062 km^2
Conservation measure: agronomic, vegetative, structural
Stage of intervention: prevention of land degradation
Origin: Developed through land user`s initiative, traditional (>50 years ago); externally / introduced through project, 10-50 years ago
Land use type:
Mixed: Agroforestry
Climate: subhumid, tropics
WOCAT database reference: T_TAN012en
Related approach:
Compiled by: Jasson Rwazo, Missenyi District Council
Date: 2012-07-11
Contact person: Fidelis Kaihura, National Project Manager, K-TAMP projetc; Agricultural Research and Development Institute Maruku P.O.Box 127 Bukoba, Tanzania. Tel: +255 754273849 E-mail: Fidelis.kaihura@fao.org

Classification

Land use problems:

- Soil nutrient loss, decline of soil moisture and soil erosion by wind and fast water runoff. (expert's point of view)
Reduced crop production, loss of indigenous medicinal plants, reduced water water quatity in natural water sources. (land user's point of view)

Land use

Agroforestry
rainfed

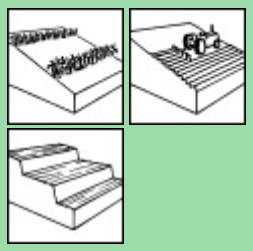
Climate

subhumid

Degradation

Soil erosion by water: loss of topsoil / surface erosion,
Chemical soil deterioration: fertility decline and reduced organic matter content,
Biological degradation: reduction of vegetation cover

Conservation measure



agronomic: Organic matter / soil fertility
vegetative: Tree and shrub cover
vegetative: Grasses and perennial herbaceous plants
structural: Level ditches / pits

Stage of intervention

- Prevention
- Mitigation / Reduction
- Rehabilitation

Origin

- Land users initiative: traditional (>50 years ago)
- Experiments / Research
- Externally introduced: 10-50 years ago

Level of technical knowledge

- Agricultural advisor
- Land user

Main causes of land degradation:
Direct causes - Human induced: soil management, crop management (annual, perennial, tree/shrub)
Direct causes - Natural: change of seasonal rainfall, droughts
Indirect causes: population pressure, education, access to knowledge and support services

Main technical functions:

- control of raindrop splash
- control of dispersed runoff: retain / trap
- control of concentrated runoff: retain / trap
- improvement of ground cover
- increase in organic matter

Secondary technical functions:

- increase in nutrient availability (supply, recycling,...)
- increase of infiltration
- water harvesting / increase water supply
- reduction in wind speed
- increase of biomass (quantity)

Environment

Natural Environment

Average annual rainfall (mm)

- > 4000 mm
- 3000-4000 mm
- 2000-3000 mm
- 1500-2000 mm
- 1000-1500 mm
- 750-1000 mm
- 500-750 mm
- 250-500 mm
- < 250 mm

Altitude (m a.s.l.)

- > 4000
- 3000-4000
- 2500-3000
- 2000-2500
- 1500-2000
- 1000-1500
- 500-1000
- 100-500
- <100

Landform

- plateau / plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Slope (%)

- flat
- gentle
- moderate
- rolling
- hilly
- steep
- very steep

Soil depth (cm)

- 0-20
- 20-50
- 50-80
- 80-120
- >120

Growing season(s): 120 days (Short rains(September to December)), 65 days (Long rains (March to June))
Soil texture: medium (loam)
Soil fertility: medium
Topsoil organic matter: medium (1-3%)
Soil drainage/infiltration: medium

Soil water storage capacity: medium
Ground water table: > 50 m

Tolerant of climatic extremes: temperature increase, seasonal rainfall increase, seasonal rainfall decrease, heavy rainfall events (intensities and amount), wind storms / dust storms, droughts / dry spells, decreasing length of growing period
Sensitive to climatic extremes: floods
If sensitive, what modifications were made / are possible: Use drainage trenches

Human Environment

Mixed per household (ha)

- <0.5
- 0.5-1
- 1-2
- 2-5
- 5-15
- 15-50
- 50-100
- 100-500
- 500-1,000
- 1,000-10,000
- >10,000

Land user: Individual / household, common / average land users, men and women
Population density: > 500 persons/km2
Annual population growth: 2% - 3%
Land ownership: individual, not titled
Land use rights: communal (organised)
Water use rights: open access (unorganised)
Relative level of wealth: average, which represents 60% of the land users; 35% of the total area is owned by average land users

Importance of off-farm income: less than 10% of all income: 90% of land users income depends on on- income
Access to service and infrastructure: low: employment (eg off-farm), drinking water and sanitation, financial services; moderate: health, education, technical assistance, market, energy, roads & transport
Market orientation: mixed (subsistence and commercial)

Implementation activities, inputs and costs

Establishment activities

- Land clearing and preparation:Slashing,uprooting tree stumps, ploughing and pitting(June to August)
- Availing and applying 54 tone Farm Yard (August to early September)
- Planting: 308 banana suckers 830 coffee and tree edge low tree seedlings (September to
- Construction of water harvesting ditches

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Labour	239.84	100%
Equipment		
- tools	61.56	100%
Agricultural		
- seedlings	53.13	100%
- compost/manure	1875.00	100%
Other		
- Cuttings	5.00	100%
-	2234.60	100%
TOTAL	**4469.13**	**100.00%**

Maintenance/recurrent activities

- Topping grass mulch
- Farm yard manure enrichment
- Removal of sediments and debris in water retention ditches.
- To replacement propping Poles
- To corve transportation cost
- Replacement of propping pole and live hedges
- Removal of sediments and debris in water retention ditches

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour	284.84	100%
Equipment		
- tools	18.75	100%
Agricultural		
- seedlings	0.00	100%
- compost/manure	975.00	100%
Other		
- Cuttings	0.00	100%
-	1653.60	100%
TOTAL	**2932.19**	**100.00%**

Remarks:
Manure is most determinate factor high transportation cost especially during establishment
Cost assesment completed in June 2012

Assessment

Impacts of the Technology

Production and socio-economic benefits

+++ increased crop yield
+++ reduced risk of production failure
+++ reduced expenses on agricultural inputs
+++ increased farm income
++ decreased workload
+ diversification of income sources

Production and socio-economic disadvantages

+ increased labour constraints

Socio-cultural benefits

+++ improved conservation / erosion knowledge
+++ improved food security / self sufficiency
++ improved health

Socio-cultural disadvantages

Ecological benefits

+++ improved harvesting / collection of water
+++ increased soil moisture
+++ reduced evaporation
+++ improved soil cover
+++ increased nutrient cycling recharge
++ reduced surface runoff
++ reduced wind velocity
++ increased biomass above ground C
+ reduced emission of carbon and greenhouse gases

Ecological disadvantages

+ increased fire risk

Off-site benefits

++ increased water availability
++ reduced damage on neighbours fields

Off-site disadvantages

Contribution to human well-being / livelihoods

Improve house hold food security and income

Benefits /costs according to land user

Benefits compared with costs	short-term:	long-term:
Establishment	slightly positive	very positive
Maintenance / recurrent	positive	very positive

Depending on regular application of manure and mulch plus good management of the farm

Acceptance / adoption:

70% of land user families have implemented the technology voluntary.
There is moderate trend towards (growing) spontaneous adoption of the technology. Limited with high labour and input cost (Manure)

Concluding statements

Strengths and → how to sustain/improve	Weaknesses and → how to overcome
Soil moisture conservation → Maintenance of water harvesting ditches and replacement of mulching materials	High labour and capital demand → Phase in implementation and regular maintenance of the technology
Soil fertility improvement → Regular application of manure and mulch	High risk of fire → Use of fire breaks
Improvement of soil structure and aeration → Manure and mulch application	
Control of soil erosion → Maintenance of plant cover and water retention ditches, manure and mulch application	
Increased house hold food security and income → Schedule regular maintenance activities	