Banana manure pits and mulching

Rwanda - Gusasira no gutera urutoki mu myobo irimo ifumbire mborera

Banana planted in a regularly spaced manured pits and in combination with grass and banana mulch application to enhance soil fertility and moisture and improve crop production.

Banana is planted in a manure pit and the soil surface is carefully covered by banana or grass mulch. The manured pit is 0.6m deep and 2.0-2.0m wide. During establishment activities pits are filled with a mixture of soil and organic manure. Attention should be made when adding the mixed soil to the pits as a radius of 20 cm starting from the center of the pit where the banana is planted must not be filled with the mixture but filled merely with soil.This will assure that banana roots grow deeper in search for the nutrients. Recommended parallel and perpendicular spacing between the banana planting pits is 5m.
Banana manured pits and mulch application is a combination of an agronomic and structural technique. This method allows nutrients to be concentrated around the roots zone and keeps longer the available soil water content and controls the soil erosion. The banana manure pits and mulching provides easy crop management options. The high demand of water and nutrients by banana can be easily met to maximize the fruiting potential. To achieve this potential, farmers are required to maintain a minimum of 3 plants per pit, one mature (grand) banana plant fruiting, a second half grown (mother), and one sucker (child) growing in the same pit. Every four months a farmer is expected to harvest a bunch of banana of around 80 kg per pit.
The constituted layer of mulch prevents rainwater from eroding the top soil, improves soil organic carbon, provides shade to plant roots, and most importantly keeps longer soil moisture in dry seasons.

left: Applying mulching in banana plantation (Photo: Ngenzi Guy)
right: Banana manure pit (Photo: Desire Kagabo)

Location: Rwanda
Region: Kirehe District (Eastern province)
Technology area: 10 - 100 km2
Conservation measure: agronomic, structural
Stage of intervention: mitigation / reduction of land degradation
Origin: Developed through land user`s initiative, 10-50 years ago
Land use type:
Cropland: Perennial (non-woody) cropping
Land use:
Grazing land: Extensive grazing land (before), Cropland: Perennial (non-woody) cropping (after)
Climate: subhumid, tropics
WOCAT database reference: T_RWA004en
Related approach: Spontaneous farmer to farmer adoption (A_RWA002en)
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Classification

Land use problems:

- Banana plantation is sensitive to dry season where evapotranspiration is high, and high erosion impact in rainy season. (expert's point of view)
Surface runoff (land user's point of view)

Land use

Perennial (non-woody) cropping
Grazing land: Extensive grazing land (before)
Cropland: Perennial (non-woody) cropping (after)
rainfed

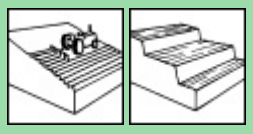
Climate

subhumid

Degradation

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

Conservation measure



agronomic: Vegetation/soil cover
structural: Level ditches / pits

Stage of intervention

- Prevention
- Mitigation / Reduction
- Rehabilitation

Origin

- Land users initiative: 10-50 years ago
- Experiments / Research
- Externally introduced

Level of technical knowledge

- Agricultural advisor
- Land user

Main causes of land degradation:
Direct causes - Human induced: soil management
Direct causes - Natural: droughts
Indirect causes: population pressure

Main technical functions:

- increase in organic matter
- increase in nutrient availability (supply, recycling,...)
- increase of infiltration
- increase / maintain water stored in soil
- water harvesting / increase water supply

Secondary technical functions:

- control of raindrop splash
- improvement of ground cover

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): 180 days (Sept to mid Febr), 150 days (mid March to mid Jun)
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: 5 - 50 m
Availability of surface water: poor / none
Water quality: poor drinking water
Biodiversity: medium

Tolerant of climatic extremes: seasonal rainfall increase, seasonal rainfall decrease
Sensitive to climatic extremes: droughts / dry spells

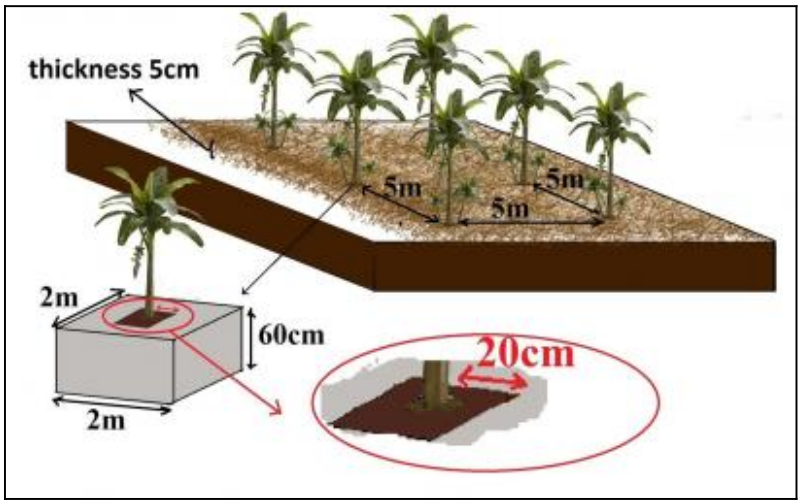
Human Environment

Cropland 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, medium scale land users, common / average land users
Population density: 200-500 persons/km2
Annual population growth: 2% - 3%
Land ownership: individual, titled
Land use rights: individual
Water use rights: open access (unorganised)
Relative level of wealth: poor, which represents 78% of the land users; 20% of the total area is owned by poor land users

Importance of off-farm income: 10-50% of all income:
Access to service and infrastructure: low: technical assistance, employment (eg off-farm), market, energy, drinking water and sanitation, financial services; moderate: roads & transport; high: health, education
Market orientation: mixed (subsistence and commercial)
Mechanization: manual labour
Livestock grazing on cropland: no



Technical drawing

This technology consists of a pit of 0.6x2x2m respectively, for depth, length and width. Banana is planted in center of each pit in which organic manure from different sources is added and mixed with the soil. The spacing along the row and between rows is 5 m. The top soil is taken back and only 15-30 kg of organic manure are added and mixed with soil. Attention should be made when adding the mixed soil to the pits as a radius of 20 cm starting from the center of the pit where the banana is planted must not be filled with the mixture but filled merely with soil. (Kagabo Desire and Ngenzi Guy)

Implementation activities, inputs and costs

Establishment activities

- Establishment of pits
- Seedling plantation
- Seedling transportation

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Labour	42.00	100%
Equipment		
- tools	30.00	100%
- Labour of thinning and weeding	85.00	100%
- Land preparation and planting	250.00	100%
Agricultural		
- compost/manure	650.00	100%
- Acquisition of suckers	937.50	100%
TOTAL	**1994.50**	**100.00%**

Maintenance/recurrent activities

- Thinning banana field
- Weeding
- Planting seedlings

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour	42.00	100%
Equipment		
- Labour of thinning and weeding	25.00	100%
TOTAL	**67.00**	**100.00%**

Remarks:
The labor affects most the cost of this technology. However, suckers or planting materials could increase the cost if not readily available at farm gate or in the neighborhood.

Assessment

Impacts of the Technology

Production and socio-economic benefits	Production and socio-economic disadvantages
+++ increased crop yield	
++ reduced risk of production failure	
++ increased farm income	
+ reduced expenses on agricultural inputs	

Socio-cultural benefits	Socio-cultural disadvantages
+++ improved food security / self sufficiency	
++ improved health	

Ecological benefits	Ecological disadvantages
+++ increased soil moisture	
+++ reduced evaporation	
++ reduced surface runoff	
++ improved soil cover	
+ reduced soil loss	

Off-site benefits	Off-site disadvantages
+ reduced groundwater river pollution	

Contribution to human well-being / livelihoods

+++ The technology increases banana production and the net farm income

Benefits /costs according to land user

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

Acceptance / adoption:

90% of land user families (43000 families; 80% of area) have implemented the technology voluntary.
There is strong trend towards (growing) spontaneous adoption of the technology.

Concluding statements

Strengths and → how to sustain/improve	Weaknesses and → how to overcome
Increased food security and income of land users → Scaling up the technology	This technology maybe expensive at establishment phase, maybe not affordable by every smallholder farmer → Allow farmers to access credits through farmer saving schemes or cooperatives
Increased water holding capacity → Good maintenance by regularly replacing mulch	
Increased soil moisture → Good maintenance by adding very often organic manure	
Increase production → Regular maintenance	
Reduce surface runoff by enhancing the retention soil moisture → Regular maintenance	