Planted maize covered with maize trash for moisture conservation (Paul Kahiga (8444-00300))

Conservation Agriculture (Kenya)

Conservation Agriculture

DESCRIPTION

Conservation Agriculture is a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment.

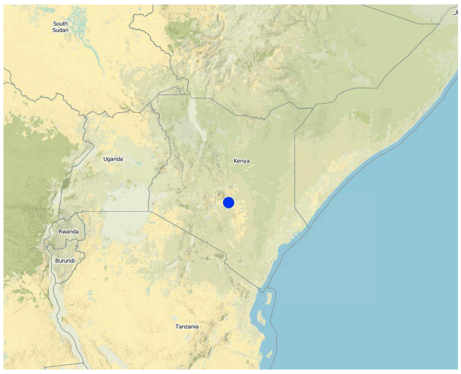
Conservation Agriculture (CA) is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. Conventional "arable" agriculture is normally based on soil tillage as the main operation. The technology is mainly practiced in the dry areas of Mbeere District where farmers experience very dry spells in most times of the year.

Purpose of the Technology: Conservation agriculture (CA) aims to achieve sustainable and profitable agriculture and subsequently aimes at improved livelihoods of farmers through the application of the three CA principles: minimal soil disturbance, permanent soil cover and crop rotations. CA holds tremendous potential for all sizes of farms and agro-ecological systems, but its adoption is perhaps most urgently required by smallholder farmers, especially those facing acute labour shortages. It is a way to combine profitable agricultural production with environmental concerns and sustainability and it has been proven to work in a variety of agroecological zones and farming systems.

Establishment / maintenance activities and inputs: The first key principle in CA is practicing minimum mechanical soil disturbance which is essential to maintaining minerals within the soil, stopping erosion, and preventing water loss from occurring within the soil.The second key principle in CA is much like the first in dealing with protecting the soil. The principle of managing the top soil to create a permanent organic soil cover can allow for growth of organisms within the soil structure. This growth will break down the mulch that is left on the soil surface. The breaking down of this mulch will produce a high organic matter level which will act as a fertilizer for the soil surface.The third principle is the practice of crop rotation with more than two species.Crop rotation can also help build up soil infrastructure. Establishing crops in a rotation allows for an extensive buildup of rooting zones which will allow for better water infiltration.

Natural / human environment: CA principles are universally applicable to all agricultural landscapes and land uses with locally adapted practices. CA enhances biodiversity and natural biological processes above and below the ground surface. Soil interventions such as mechanical soil disturbance are reduced to an absolute minimum or avoided, and external inputs such as agrochemicals and plant nutrients of mineral or organic origin are applied optimally and in ways and quantities that do not interfere with, or disrupt, the biological processes.

LOCATION



Location: Mbere South District, Eastern Province, Kenya

No. of Technology sites analysed:

Geo-reference of selected sites
- 37.7929, -0.57651

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

In a permanently protected area?:

Date of implementation:

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

Crop land with deep holes for planting seeds in order to facilitate root penetrationand conserve moisture (Paul Kahiga (8444-00300))

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

Number of growing seasons per year: 1
Is crop rotation practiced? Yes

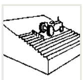
Water supply
- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

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

Degradation addressed


biological degradation - Bq: quantity/ biomass decline

SLM group
- rotational systems (crop rotation, fallows, shifting cultivation)
- improved ground/ vegetation cover
- minimal soil disturbance

SLM measures


agronomic measures - A2: Organic matter/ soil fertility, A3: Soil surface treatment (A 3.1: No tillage)

TECHNICAL DRAWING

Technical specifications
The technical drawing on the left side shows rows of newly planted maize crops alternated by trumps of previous rows of old harvested crop. The previous crop residues are either collected and used as animal feeds or put on rows along the contours to supplement the earth or stone bunds.

Location: Mbeere South District. Eastern Province
Date: 02/09/2012

Technical knowledge required for field staff / advisors: moderate
Technical knowledge required for land users: moderate

Main technical functions: control of raindrop splash, control of dispersed runoff: retain / trap, improvement of ground cover, increase of surface roughness

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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated:
- Currency used for cost calculation: **Kshs**
- Exchange rate (to USD): 1 USD = 100.0 Kshs
- Average wage cost of hired labour per day: 5.00

Most important factors affecting the costs
Labour is the most determinate factor affecting the costs.

Establishment activities
1. Purchase Seeds (Timing/ frequency: None)
2. Purchase Panga (Timing/ frequency: None)
3. Purchase Hoe (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Kshs)	Total costs per input (Kshs)	% of costs borne by land users
Labour					
Labour	ha	1.0	50.0	50.0	100.0
Equipment					
Tools	ha	1.0	15.0	15.0	100.0
Plant material					
Seeds	ha	1.0	50.0	50.0	100.0
Fertilizers and biocides					
Biocides	ha	1.0	20.0	20.0	100.0
Total costs for establishment of the Technology				**135.0**	
Total costs for establishment of the Technology in USD				*1.35*	

Maintenance activities
1. weeding (Timing/ frequency: 2)
2. harvesting (Timing/ frequency: 1)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Kshs)	Total costs per input (Kshs)	% of costs borne by land users
Labour					
Labour	ha	1.0	30.0	30.0	100.0
Equipment					
Tools	ha	1.0	50.0	50.0	100.0
Plant material					
Seeds	ha	1.0	20.0	20.0	100.0
Fertilizers and biocides					
Biocides	ha	1.0	20.0	20.0	100.0
Total costs for maintenance of the Technology				**120.0**	
Total costs for maintenance of the Technology in USD				*1.2*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 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
- [x] semi-arid
- [ ] arid

Specifications on climate
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
- [x] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1,000 m a.s.l.
- [ ] 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
- [ ] medium
- [x] 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
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

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

Level of mechanization
- [x] manual work
- [x] 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
- [ ] 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
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

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

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

Access to services and infrastructure

		1	2	3	
health	poor		✓		good
education	poor	✓			good
technical assistance	poor		✓		good

IMPACTS

Socio-economic impacts

		1	2	3	4	5	6	7	
Crop production	decreased							✓	increased
fodder production	decreased		✓						increased
risk of production failure	increased							✓	decreased
land management	hindered							✓	simplified
farm income	decreased						✓		increased
diversity of income sources	decreased				✓				increased

Socio-cultural impacts

		1	2	3	4	5	6	7	
SLM/ land degradation knowledge	reduced							✓	improved
Improved livelihoods and human well-being	decreased						✓		increased

Ecological impacts

		1	2	3	4	5	6	7	
surface runoff	increased							✓	decreased
soil moisture	decreased							✓	increased
soil cover	reduced							✓	improved
soil organic matter/ below ground C	decreased							✓	increased

Off-site impacts

buffering/ filtering capacity (by soil, vegetation, wetlands) — reduced ✓ improved

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

CLIMATE CHANGE

Gradual climate change

annual temperature increase — not well at all ✓ very well

Climate-related extremes (disasters)

drought — not well at all ✓ very well

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%

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

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

- Improves soil structure and protects the soil against erosion and nutrient losses by maintaining a permanent soil cover and minimizing soil disturbance.
- Enhance soil organic matter (SOM) levels and nutrient availability by utilizing the previous crop residues
- Soil nutrient supplies and cycling are enhanced by the biochemical decomposition of organic crop residues at the soil surface that are also vital for feeding the soil microbes

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

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

- Contamination of water ecosystems by herbicides Use the right doses of herbicides and follow instructions of the manufacturer
- Reduced fodder production as some of the crop residuals that are supposed to be fed to the animals are used as soil cover materials Use of other crop residuals to supplement cover materials

REFERENCES

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Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_1323/

Linked SLM data

n.a.

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