Large-scaled minimum-tillage soy/corn agriculture in the typical agroscape of central Brazil. (Stefan Hohnwald (Goldschmidtstr. 5, 37077 Göttingen, Germany))

Minimum tillage (Brazil)

Plantio direto

DESCRIPTION

Seed of maize and soy are planted directly into the soil with a minimum previous tillage impact.

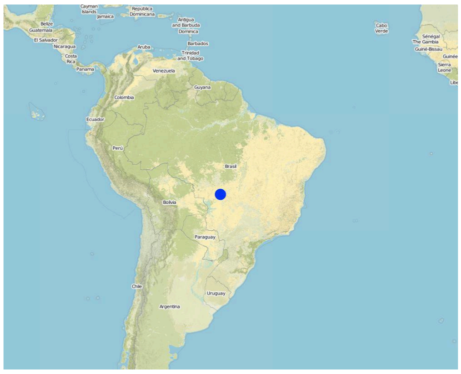
After harvesting stubbles of maize or soy remain on site. When the planting season started the soil is opened by rolling discs pulled by a tractor. The seeds are directly put into the open soil which is compacted afterwards with rolling wheels of the same machine.

Purpose of the Technology: With minimum tillage practices tilling and seeding operations could be implemented fast and very efficient. The high power of impact allows the cultivation of large fields in short time, especially if small windows of wet initial conditions need to be used. The purpose is to avoid deep plowing of the soils that would need much higher energy and costs and would lead to typical serious erosion problems in the tropics.

Establishment / maintenance activities and inputs: The technology was implemented in the area since approximately 15 years. High technological standard of tillage tools, tractors and service is needed. Since the whole farm system has changed, farmer need special knowledge in no-till measures especially with regard to pest management.

Natural / human environment: The region belongs to the semi-humid tropics and to the cerrado biome in the centre of the South American continent. Natural vegetation has been deforested some 20-40 year ago and was shifted to soy bean fields, pastures, corn and sugar cane fields.

LOCATION



Location: Campo Verde, Primavera do Leste, Mato Grosso, Brazil

No. of Technology sites analysed:

Geo-reference of selected sites
- -55.17105, -15.58398

Spread of the Technology: evenly spread over an area (approx. > 10,000 km2)

In a permanently protected area?:

Date of implementation: 10-50 years ago

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

Heavy machinery with 15 ploughing elements for large-scale agriculture. (Stefan Hohnwald (Goldschmidtstr. 5, 37077 Göttingen, Germany))

Minimized physical effects of the no-tillage technology on the soils. (Stefan Hohnwald (Goldschmidtstr. 5, 37077 Göttingen, Germany))

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [ ] 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
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Land use mixed within the same land unit: Yes - Agroforestry

Cropland

- Annual cropping: cereals - maize, cereals - millet, fibre crops - cotton

Number of growing seasons per year: 2
Is intercropping practiced? Yes

Forest/ woodlands Products and services: Timber, Fuelwood, Nature conservation/ protection

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

SLM group

- minimal soil disturbance

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A3: Soil surface treatment

structural measures - S1: Terraces

management measures - M1: Change of land use type, M2: Change of management/ intensity level, M6: Waste management (recycling, re-use or reduce)

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **Real Brasileiro**
- Exchange rate (to USD): 1 USD = 3.06 Real Brasileiro

Most important factors affecting the costs

Costs are determined by the enormous field size and the soil type

- Average wage cost of hired labour per day: 15.00

Establishment activities
1. Bulldozing (Timing/ frequency: dry season)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Real Brasileiro)	Total costs per input (Real Brasileiro)	% of costs borne by land users
Labour					
Bulldozing	ha	1.0	3000.0	3000.0	
Total costs for establishment of the Technology				**3'000.0**	
Total costs for establishment of the Technology in USD				*980.39*	

Maintenance activities
1. reparation (Timing/ frequency: yearly)

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 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
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
September-April
Thermal climate class: tropics. 25.6

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

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [ ] 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%)
- [x] 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
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [ ] No

Species diversity
- [x] high
- [ ] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] 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
- [ ] average
- [x] rich
- [x] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [x] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [x] large-scale

Land ownership
- [ ] state
- [x] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] 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

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
production area (new land under cultivation/ use)	decreased	□□□✓□□□	increased
land management	hindered	□□□✓□□□	simplified
energy generation (e.g. hydro, bio)	decreased	□□□□✓□□	increased
expenses on agricultural inputs	increased	□□□□✓□□	decreased

Socio-cultural impacts

conflict mitigation	worsened	□□□✓□□□	improved

Ecological impacts

water quantity	decreased	□□□✓□□□	increased
water quality	decreased	□□□✓□□□	increased
surface runoff	increased	□□□□✓□□	decreased
excess water drainage	reduced	□□□✓□□□	improved
groundwater table/ aquifer	lowered	□□□✓□□□	recharge
evaporation	increased	□□□✓□□□	decreased
soil moisture	decreased	□□□□✓□□	increased
soil cover	reduced	□□□□□✓□	improved
soil loss	increased	□□□□✓□□	decreased
soil compaction	increased	□□□✓□□□	reduced
nutrient cycling/ recharge	decreased	□□□✓□□□	increased
soil organic matter/ below ground C	decreased	□□□□✓□□	increased
biomass/ above ground C	decreased	□□□✓□□□	increased
emission of carbon and greenhouse gases	increased	□□□□✓□□	decreased
wind velocity	increased	□□□✓□□□	decreased

Off-site impacts

water availability (groundwater, springs)	decreased	□□□✓□□□	increased
reliable and stable stream flows in dry season (incl. low flows)	reduced	□□□✓□□□	increased
downstream flooding (undesired)	increased	□□□✓□□□	reduced
wind transported sediments	increased	□□□✓□□□	reduced

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)

local rainstorm	not well at all	□✓□□□	very well	
local windstorm	not well at all	□□□□□	very well	Answer: not known
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	

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%
- [x] 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

- The no-tillage technology reduced soil erosion by water and helps to minimize carbon release into the atmosphere. It reduces management costs in the long run.

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

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

- No tillage is a high-input technology that needs some expensive investments in the beginning.

REFERENCES

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Resource persons

Stefan Hohnwald - SLM specialist
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Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_1270/

Linked SLM data

n.a.

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Project

- n.a.