The Dyker in use with a Grimme GL 420 potato planter (Tatenda Lemann)

Dyker System (Switzerland)

Dyker-System (oder Lochstern) im Kartoffelanbau

DESCRIPTION

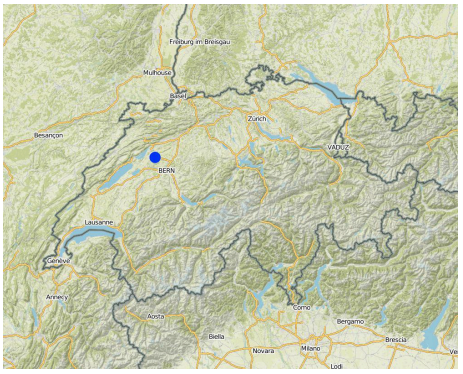
The Dyker consists of a set of wheels with three to four inclined shovels each. Attached to the rear end of the planting machine, it digs holes into the bottom of the furrows between the potato hills.

The Dyker system consists of a new tractor trailer for cultivating potatoes. It was established by Grimme from Germany. With this new technology small holes and micro-dams are built in the furrows between the potato hills. They are intended to improve water infiltration and to help retain water near the plants, while preventing waterlogging and stagnant water in depressions and minimizing surface runoff and soil erosion.

On conventionally farmed potato fields (where an all-in-one potato planter can be used) no additional working steps are necessary and the Dyker can be used simultaneously with the potato planting machine. This saves time and money. For other crops or if no all-in-one potato planter is used, the Dyker can also be attached to a tractor as an individual trailer (without potato planter). Then one ore more additional working steps are needed after plantation.

The system is intended to prevent soil erosion and waterlogging during the cultivation process of potatoes. Furrows running parallel to the gradient are mostly endangered by soil erosion during the first 4-8 weeks until soil cover reaches a certain percentage. Small holes and micro-dams in the furrows increase infiltration and reduce surface runoff and thereby prevent soil erosion and water logging.

LOCATION



Location: Bern, Wiler bei Seedorf, Switzerland

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 7.31315, 47.05557

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
- ☑ through contructors' innovation

The Dyker attached to a Grimme GL 420 potato planter (Tatenda Lemann)

Furrows prepared with and without Dyker. Left: after plantation, right: 1,5 month after plantation. (Tatenda Lemann)

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

Land use

Cropland

- Annual cropping: root/tuber crops - potatoes

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

SLM group

- cross-slope measure
- water diversion and drainage

SLM measures

agronomic measures - A3: Soil surface treatment, A4: Subsurface treatment

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Dyker (attachment for tractor or potato planter)**)
- Currency used for cost calculation: **CHF**
- Exchange rate (to USD): 1 USD = 1.0 CHF
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

- If the Dyker belongs to a contractor with a all-in-one potato planter, no additional costs are expected for the farmer (but for the contractor) - If the Dyker is not attached to a all-in-one potato planter but e.g. to a tractor, additional working steps are necessary.

Establishment activities

1. Dyker system usage during cultivation of potatoes (Timing/ frequency: During or after potato plantation)

Establishment inputs and costs (per Dyker (attachment for tractor or potato planter))

Specify input	Unit	Quantity	Costs per Unit (CHF)	Total costs per input (CHF)	% of costs borne by land users
Labour					

Labour	days/year	2.0	250.0	500.0	
Equipment					
Dyker	piece	1.0	8500.0	8500.0	
Total costs for establishment of the Technology				**9'000.0**	
Total costs for establishment of the Technology in USD				*9'000.0*	

Maintenance activities
n.a.

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
Thermal climate class: temperate

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

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [x] 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
- [x] 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)
- [x] 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
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [x] Nee

Occurrence of flooding
- [ ] Ja
- [x] Nee

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
- [ ] very rich

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

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

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

Gender
- [ ] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [x] 5-15 ha
- [x] 15-50 ha

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

Land ownership
- [ ] 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)

- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] 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
risk of production failure	increased	decreased
workload		
	increased	decreased

When used with potato planter not additional work step needed. Workload is slightly increasing due to preparation of the Dyker.

Socio-cultural impacts

SLM/ land degradation knowledge	reduced	improved
conflict mitigation	worsened	improved

Ecological impacts

surface runoff	increased	decreased
soil loss	increased	decreased
Hazard towards adverse events	improved	reduced

Off-site impacts

downstream flooding (undesired)	increased	reduced
damage on neighbours' fields	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	Answer: not known
general (river) flood	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%
- [x] 11-50%
- [ ] > 50%

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

- [ ] 0-10%
- [ ] 11-50%
- [x] 51-90%
- [ ] 91-100%

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

- [ ] Ja
- [x] Nee

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

- The small holes and micro dams in the furrows enhance infiltration, reduce surface runoff and prevent soil erosion and waterlogging.

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

- The problematic crop of potatoes can be prevented from soil erosion thanks to the Dyker system.

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

- The weight of the Dyker which is added behind the axe --> more difficult to maneuver the machine Good technical skills and experience with big, heavy machines are necessary to use the Dyker system correctly. In terms of risk of soil compaction this is negligible, as the dyker does not add much to the total weight of the machinery.
- price of Dyker: US$ 8000 – 8500 for a contractor these costs are not a problem. However, for a single farmer the price is high Shared use of the Dyker can reduce costs for individual farmer

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

REFERENCES

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Resource persons
Deborah Niggli - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1304/
Video: https://player.vimeo.com/video/260021412

Linked SLM data
n.a.

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Links to relevant information which is available online
- RECARE Project Dissemination Hub: http://www.recare-hub.eu/stakeholder-platforms/frienisberg-switzerland