No-till seeding (right) and conventional tillage seeding (left) at a 10-ha field trial (Insa Kuehling (Hochschule Osnabrueck, Am Krümpel 31, 49090 Osnabrück))

No-till crop production (Russian Federation)

Nulevaya obrabotka, Notill

DESCRIPTION

No-till farming (also called zero tillage or direct drilling) is a way of growing crops from year to year without disturbing the soil through tillage.

No-till seeding (also direct-drilling, or direct-seeding) is most commonly identified by the feature that during tillage operations, as much as possible of the surface residue from the previous crop is left intact on the surface of the ground, whether this be the flattened or standing stubble of an arable crop that has been harvested or a sprayed dense sward of grass.

Purpose of the Technology: The purpose of no-till is to increase working efficiency (i.e. to save fuel, time and labour), increase soil organic matter and nitrogen contents, preserve soil structure and soil fauna, improve aeriation and water infiltration, conserve soil moisture, prevent soil erosion, and increase yields.

Establishment / maintenance activities and inputs: We use field trials to evaluate if and to which extent no-till seeding can contribute to sustainable land-management in Western Siberia. In cooperation with a large local agricultural enterprise, Agroholding Yubileinij, and a German manufacturer of agricultural machinery (AMAZONEN-Werke H. Dreyer GmbH & Co. KG), a field trial on 10 ha was set up near the city of Ishim, Tyumen province. In a randomized block design, two seeding parameters were varied, namely seeding depth and seeding rate (number of wheat seeds/ha). Both options were tested under conventional tillage, and no-till seeding, over three seasons (2013–2015).
The parameters soil moisture, plant available soil nitrogen content and grain yield were compared between all possible options of tillage approach (no-till/till), seeding depth and seeding rate.

LOCATION

Location: Tyumen oblast (province), Russian Federation, Russian Federation

No. of Technology sites analysed:

Geo-reference of selected sites
- 67.46301, 56.49204

Spread of the Technology:

In a permanently protected area?:

Date of implementation:

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

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

Land use

Cropland
- Annual cropping: root/tuber crops - potatoes, wheat

Number of growing seasons per year: 1

- [ ] 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

Forest/ woodlands Products and services: Timber, Fruits and nuts

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

Purpose related to land degradation
- [x] prevent land degradation
- [x] 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

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

water degradation - Ha: aridification

SLM group
- minimal soil disturbance

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment (A 3.1: No tillage)

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

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

Most important factors affecting the costs
fuel price, wages

Establishment activities
n.a.

Maintenance activities
n.a.

NATURAL ENVIRONMENT

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

Specifications on climate
Average annual rainfall in mm: 297.0
No dry period, 170 day growing season
Thermal climate class: temperate

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
- [x] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 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)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [x] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] 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)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 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
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [x] employee (company, government)

Gender
- [x] women
- [x] men

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

Area used per household
- [x] < 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
- [ ] 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
- [ ] 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	Quantity before SLM: 2.5 t/ha Quantity after SLM: 2.75 t/ha
fodder production	decreased	increased	Quantity before SLM: 2.5 t/ha Quantity after SLM: 2.75 t/ha
risk of production failure	increased	decreased	
expenses on agricultural inputs	increased	decreased	Quantity before SLM: 29 l/ha Quantity after SLM: 3.7 l/ha Reduced fuel consumption. On the other hand increased use of agro-chemicals (herbicides and/ or pesticides +20-50%)
farm income	decreased	increased	

Socio-cultural impacts

Social acceptance	decreased	increased	Strong tradition to use conventional techniques
Improved livelihoods and human well-being	decreased	increased	

Ecological impacts

evaporation	increased	decreased	
soil moisture	decreased	increased	+ 40%
soil cover	reduced	improved	
soil organic matter/ below ground C	decreased	increased	
biomass/ above ground C	decreased	increased	
plant diversity	decreased	increased	Increase in weed species
wind velocity	increased	decreased	

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Benefits compared with maintenance costs

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	
drought	not well at all	very well	
general (river) flood	not well at all	very well	Answer: not known

Other climate-related consequences

reduced growing period	not well at all	very well	Answer: not known

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

- as above

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

- potential to maintain and improve soil fertility
- potential to increase yields
- potential to safe on-farm costs, i.e. make production per area unit more efficient
- potential to ensure stable yields under varying climatic conditions

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

- as above

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

- need for more chemical plant protection and weed control, therefore more herbicide applications needed, environmental externalities
- well-educated, leading/advisory staff needed to implement technology

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1288/

Linked SLM data
n.a.

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Key references
- http://www.uni-muenster.de/SASCHA/en/index.html: free!

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