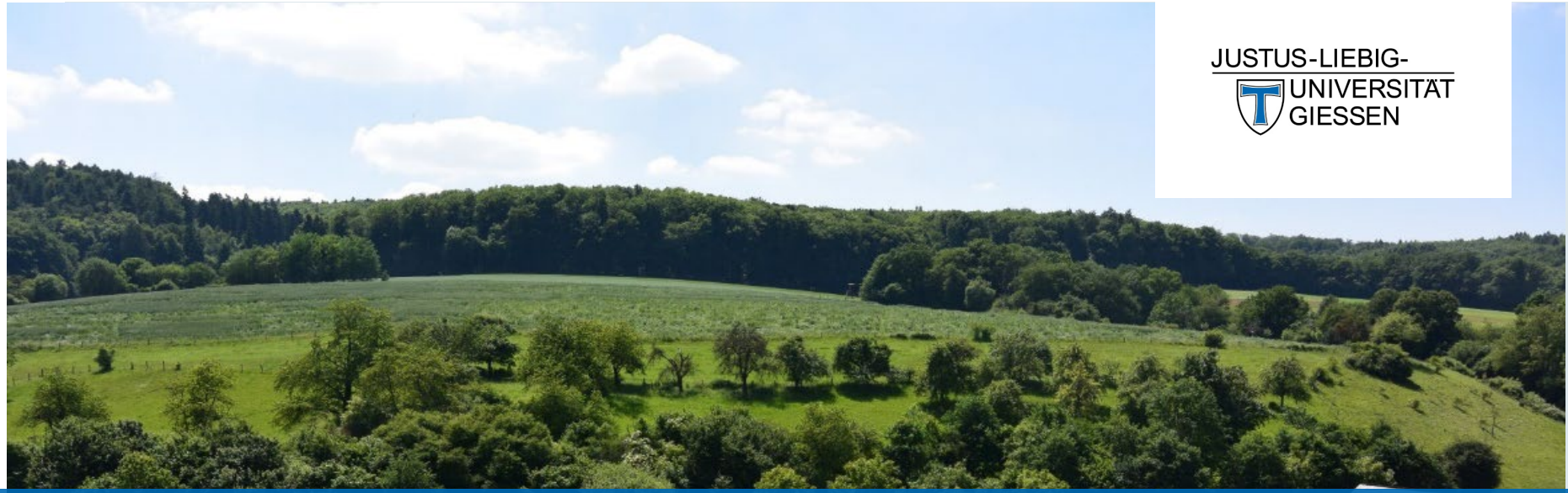
EU ResidueGas, 03.05.2021



Crop Residues in Conservation Agriculture

Andreas Gattinger

andreas.gattinger@agrar.uni-giessen.de

Consequences of poor land use and tillage practices

…the solution: Conservation Agriculture

A tillage system encompassing 3 core practices (ECAF):

i) minimum soil disturbance: NT: no-till (= direct seeding); RT: reduced tillage (shallow inversion, shallow loosening, strip till,…)

ii) maintenance of permanent soil cover (residues from pre-crops, current crop)

iii) cropping systems diversity: green manure leys and extended crop rotations

„No Tillage“ Area (in Mill. ha): Global 125, USA 26,5, Argentina 25.6, Brazil 25.5 (Germany 650.000 ha, Germany < 10.000 ha) (Friedrich et al. 2012)

Friedrich et al. 2012

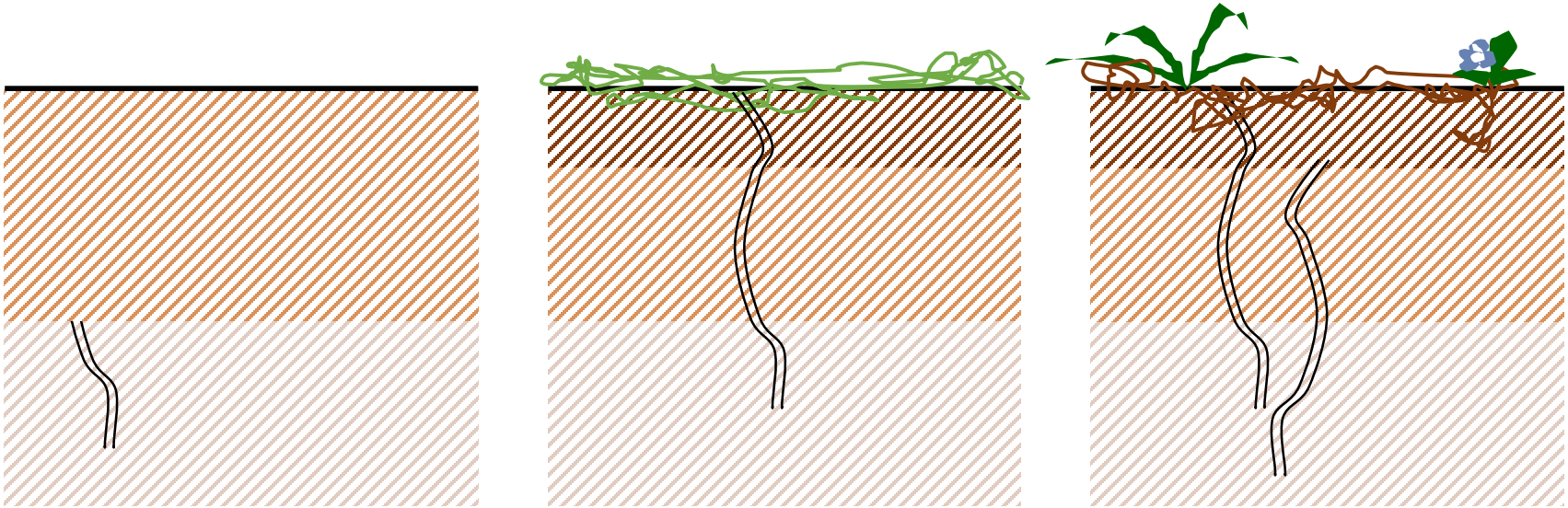
Conservation Agriculture – an overview

Integrated production

Plough

No-till with herbicides

Reduced tillage in organic farming



Conservation tillage in large-scale agriculture

www.deere.com/en_US/products/equipment/planting_and_seeding_equipment/air_seeding/no_till_air_drill_series/no_till_air_drill_series.page

Copyright: A. Gattinger

www.horsch2.com/de/mediathek-downloads/solr-filter/topics%253AS%25C3%25A4technik

Conservation tillage in small-scale agriculture


Photo: Patrick Wall


Photo: Christian Thierfelder


Photo: Patrick Wall

in: Gattinger, A., Jawtusch,J., Muller, A. and Mäder, P., (2011) No-till agriculture – a climate-smart solution? Miseror, Report No. 2 Climate Change and Agriculture series. 24 pages. http://m.misereor.de/fileadmin/redaktion/MISEREOR_no%20till.pdf

Conservation tillage – does it really work?

Impact category	Effect sizes	Impact	References
Soil conservation	various	**positive**	27, 28, 45-49
Water conservation	various	**positive**	48-52

(Refs. in Gattinger et al. 2011, Misereor)

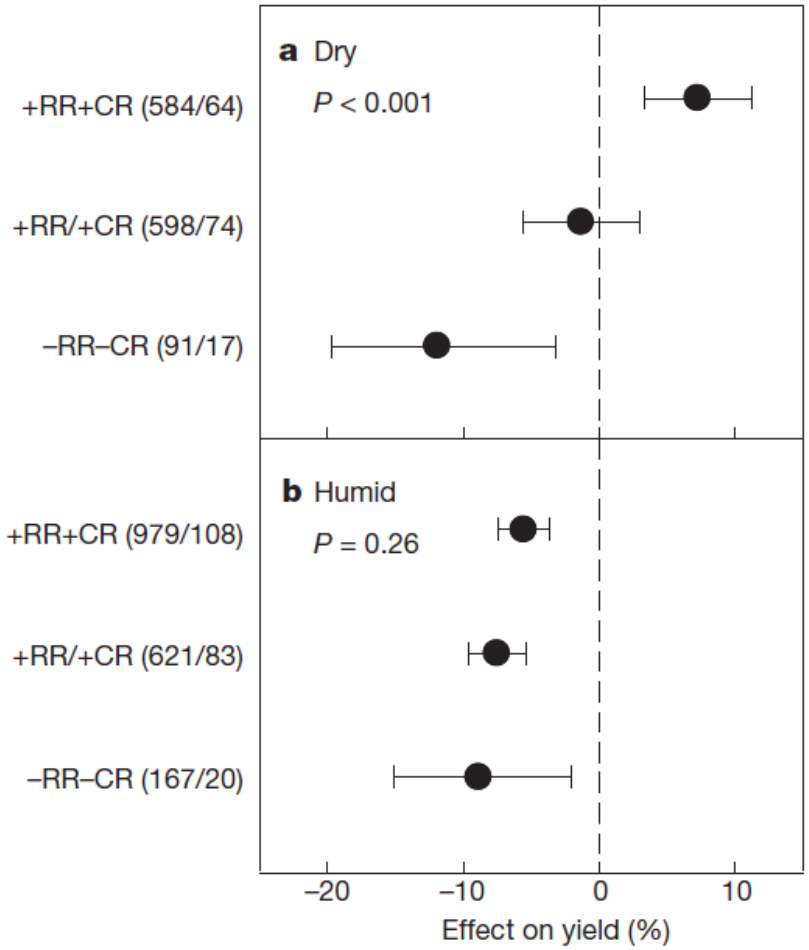
https://orgprints.org/id/eprint/20302/1/MISEREOR_no_till.pdf

Crop Residues in Conservation Agriculture – impact on yield and soil carbon

1. **Impact of conventional conservation tillage**

2. Impact of organic conservation tillage

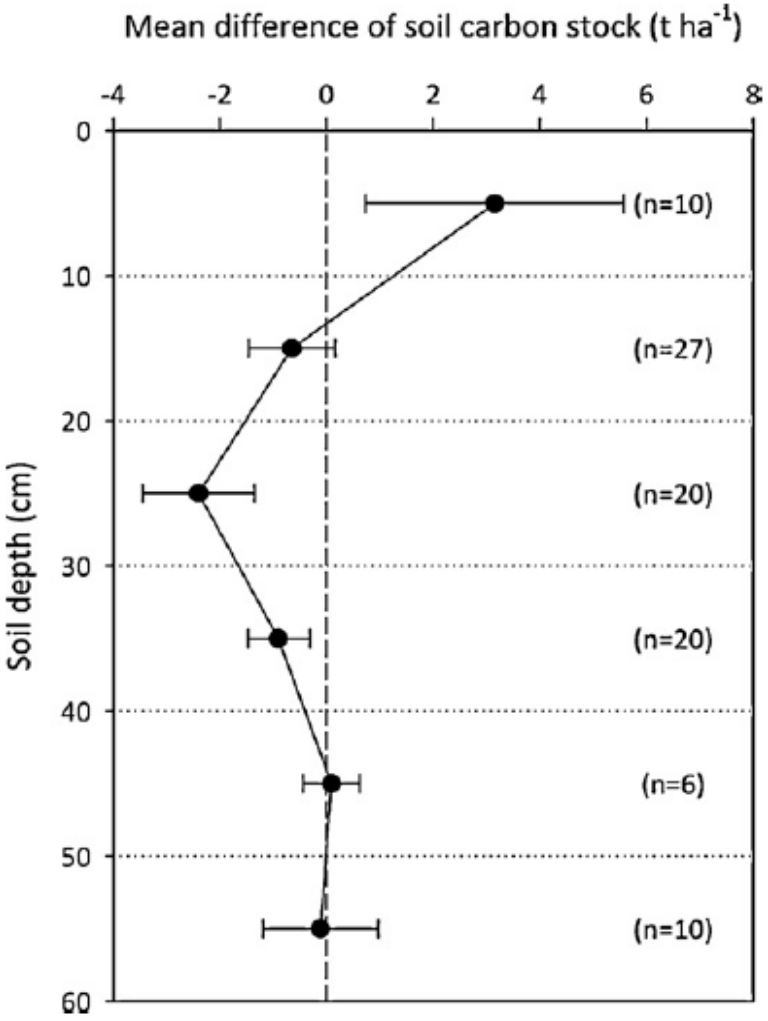
Productivity of (conventional) conservation agriculture



Reduced yield globally of 5.7%. However, increased yield if the two other principles of conservation tillage are practiced (residue retention and crop rotation), which means even higher yields in arid climates.

Pittelkow et al., 2014, Nature

Soil carbon under conservation agriculture



More carbon only in the top 15 cm of the soil. Important for soil protection!

No C sequestration under no-till related to 0-60 cm soil profile!

Predominantly cash crops, hardly no green manure crops (forage legumes, catch crops)

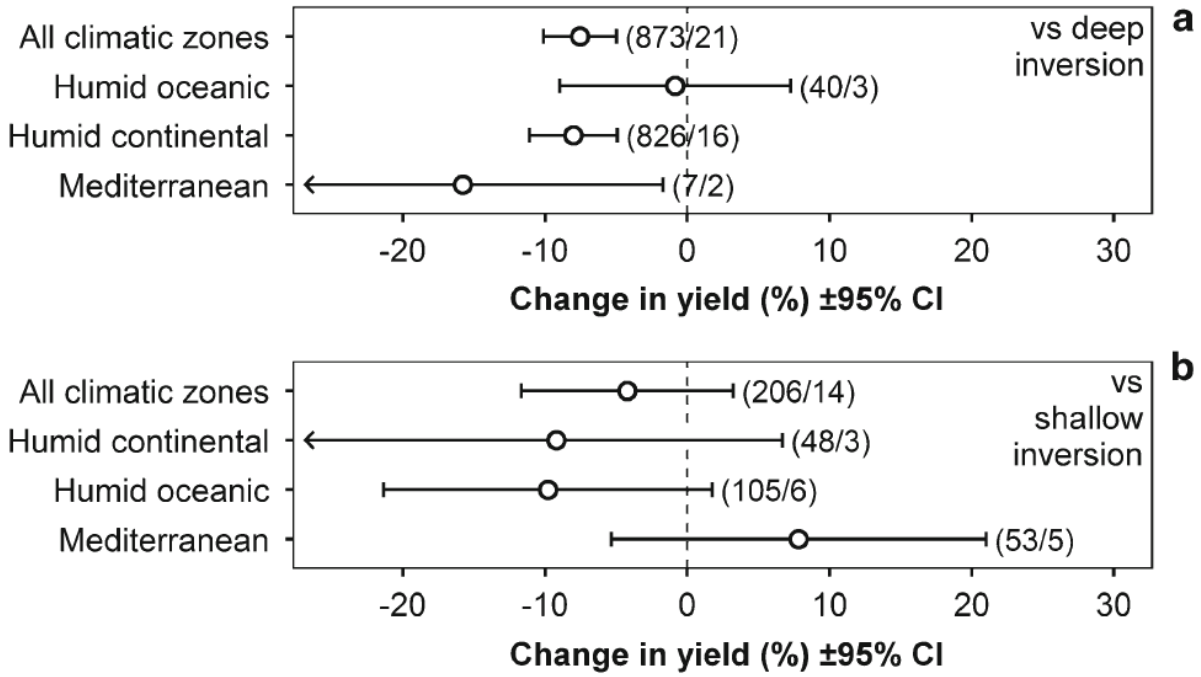
Luo et al. AGEE, 2010; Dimassi et al., AGEE, 2014; Powlson et al. Nat. Clim Change, 2014

Crop Residues in Conservation Agriculture – impact on yield and soil carbon

1. Impact of conventional conservation tillage

2. **Impact of organic conservation tillage**

Productivity of organic conservation agriculture



Tendency of lower yield: Reduced yield only when compared to deep inversion (≥ 25 cm soil depth).

All organic tillage systems include wide crop rotations (≥ 5 years) and green manure crops over winter

Cooper et al., 2016, Agron. Sustain. Dev.

Soil carbon under organic conservation agriculture (SOCORT Project, 9 European field trials)

- Reduced tillage in organic farming stratifies SOC stocks similarly to no till with herbicide use
- Reduced tillage has a slightly positive effect on C sequestration compared to ploughing
- Deep soil sampling is needed to fully catch the SOC sequestration potential
- Weed biomass input may be an important C input under organic reduced tillage

Krauss et al., submitted

Outlook: More research on mulch farming, intercropping and catch crop integration…

Vegtable cropping with mulch – more resilient?

More research and breeding efforts for catch (= green manure crops)…

Biology and Fertility of Soils (2020) 56:943–957
https://doi.org/10.1007/s00374-020-01475-8

ORIGINAL PAPER

Check for updates

Catch crop diversity increases rhizosphere carbon input and soil microbial biomass

Norman Gentsch[1] · Jens Boy[1] · Juan Daniel Kennedy Batalla[1] · Diana Heuermann[2] · Nicolaus von Wirén[2] · Dörte Schweneker[3] · Ulf Feuerstein[3] · Jonas Groß[4] · Bernhard Bauer[4] · Barbara Reinhold-Hurek[5] · Thomas Hurek[5] · Fabricio Camacho Céspedes[6] · Georg Guggenberger[1]

Received: 5 February 2020 / Revised: 29 April 2020 / Accepted: 3 May 2020 / Published online: 23 May 2020