

Actual status and tillage trends in Switzerland



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Switzerland – moderate climate in central Europe

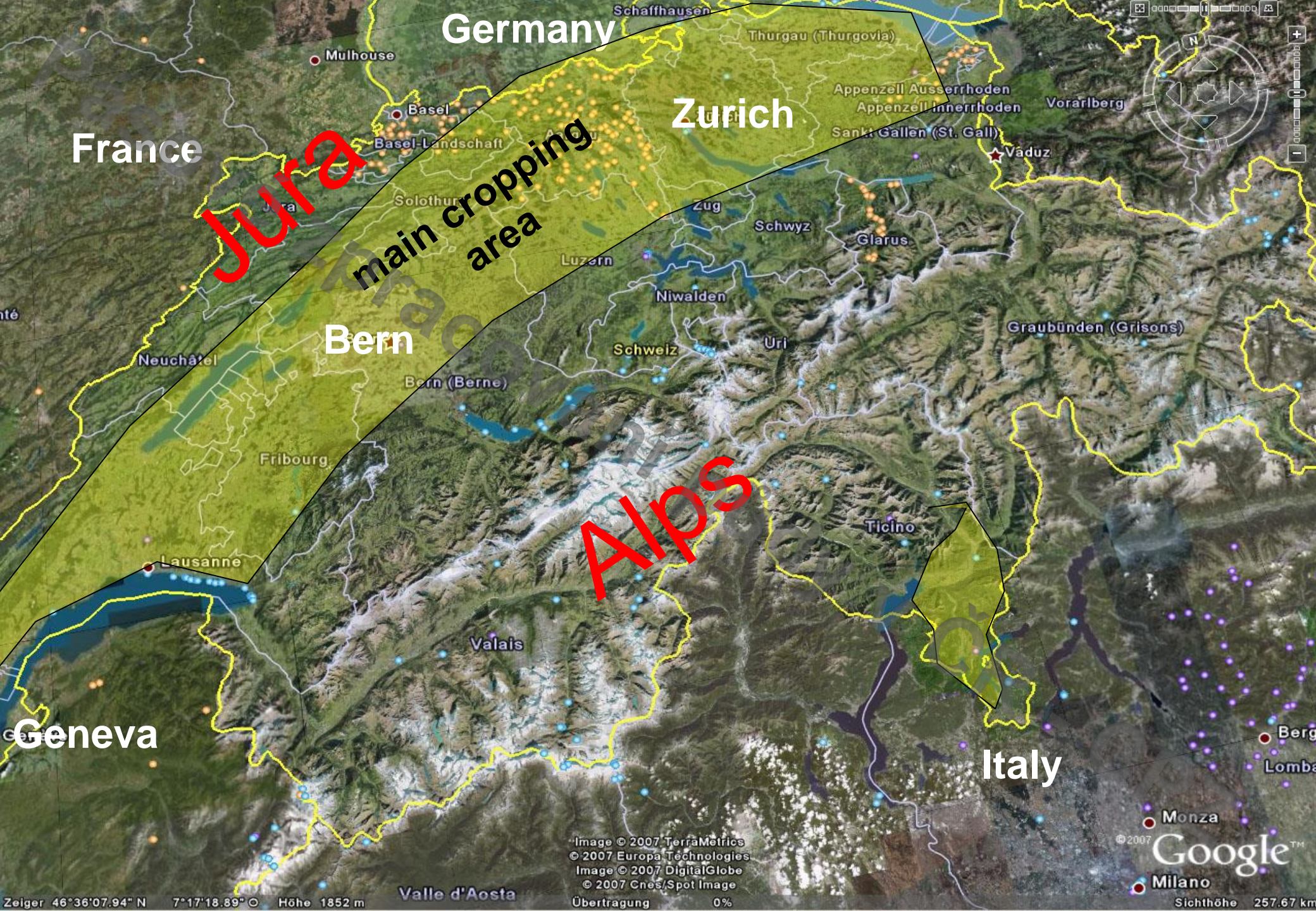


8 mio inhabitants
40'000 km²

7'000 km² grassland
3'000 km² crops

800 – 1500 mm
(and more) rainfall

Main crops:
wheat, barley, corn,
canola, sugar beet



Germany

France

Jura

main cropping area

Zurich

Bern

AIPS

Geneva

Italy

Image © 2007 TerraMetrics
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Übertragung 0%

Zelger 46°36'07.94" N 7°17'18.89" O Höhe 1852 m

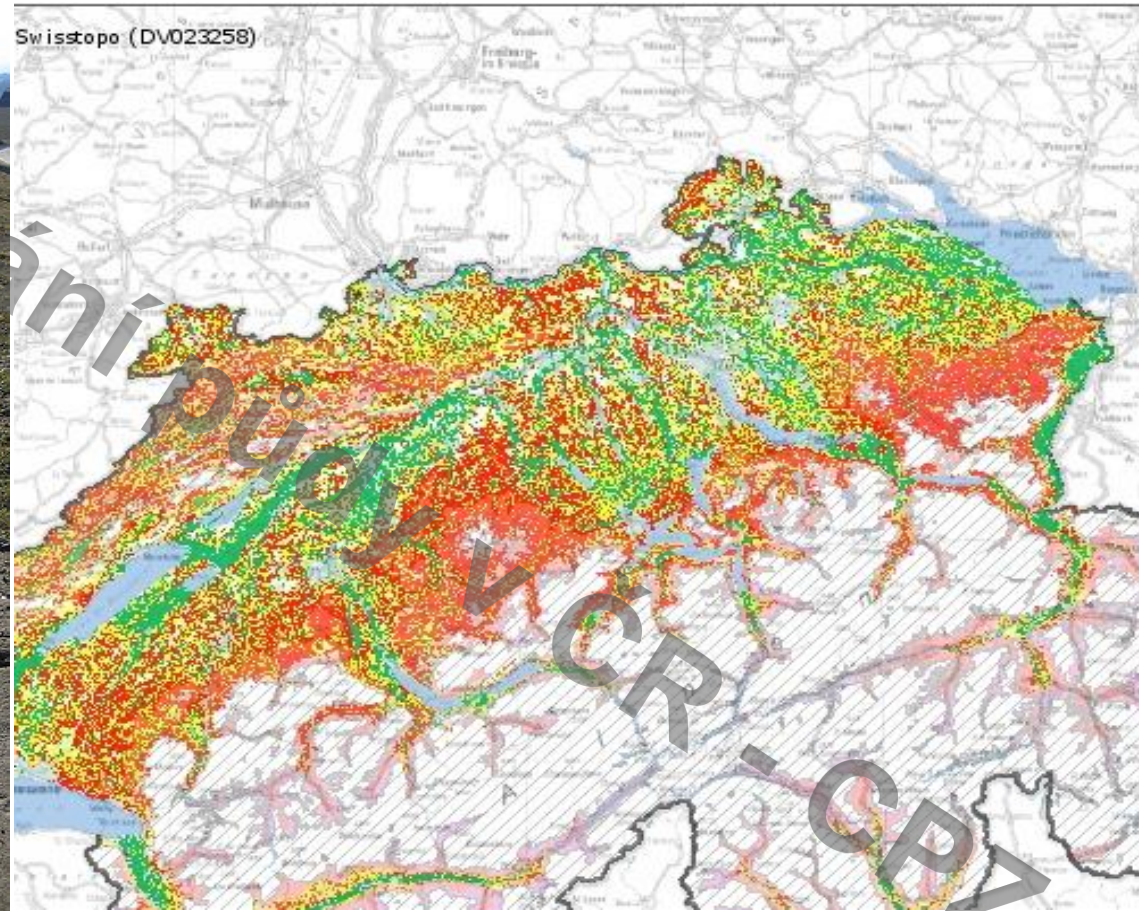
Valle d'Aosta

Monza
Milano
Sichthöhe 257.67 km
Google

Soil erosion are a plot specific problem

Soil erosion risk map of Switherland www.agri-gis.admin.ch
(publications of Prasuhn et. al.)

- Soil erosion is a plot specific and not a general problem
- Nearly no occurrence of wind erosion



Rotary harrows are still widely used



Ploughed surfaces: around 50 %
Shallow tillage 45 %
No-till about 5 %

→ State is subsidising ploughless tillage with payments of about 150 €/ha

A good soil structure is the key to success for min. till.



challenges

- loose soil structure to avoid yield depressions
- permanent soil cover to increase soil organic carbon and soil life → crop rotation



Soil compaction can cause poor crop development and yield losses

→ High amounts of rainfall can cause ponding water

Soil compaction in practice



Strips in winter wheat (no till) after strip till of corn

Compacted soil in meadow before corn

Compaction is visible 2 years afterwards

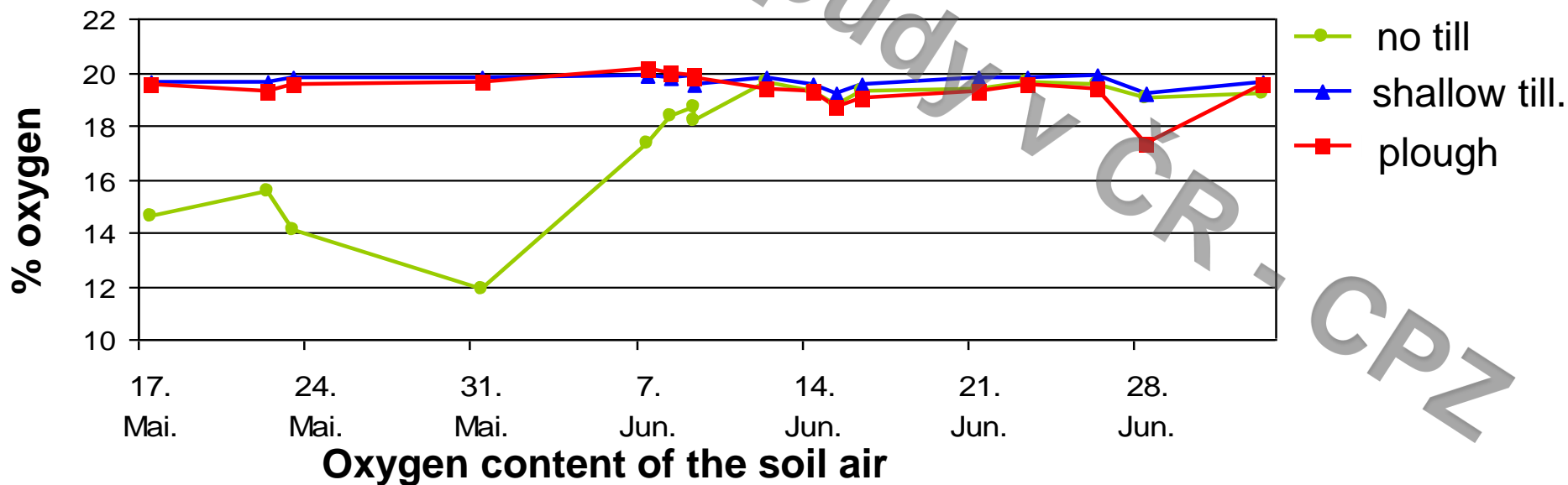
Meadow → corn (strip tillage) → wheat (no till)



**between strips
→ compaction**

**strip tillage the
year before**

Consequences of the compaction of the upper soil layers



How deep and intense should we till the soils?

Experiences of long-term Swiss trials

- Agroscope Changins 40 years of shallow tillage compared to ploughing (Vullioud, P.; Charles R.; Maillard A. et al....)
- Agroscope Tänikon 22 years of no-till (Anken T., Weisskopf P., Hermle S. et al)
- Canton Bern, Oberacker 20 years of no-till compared to plough (Chervet A., Sturny W. et al.)

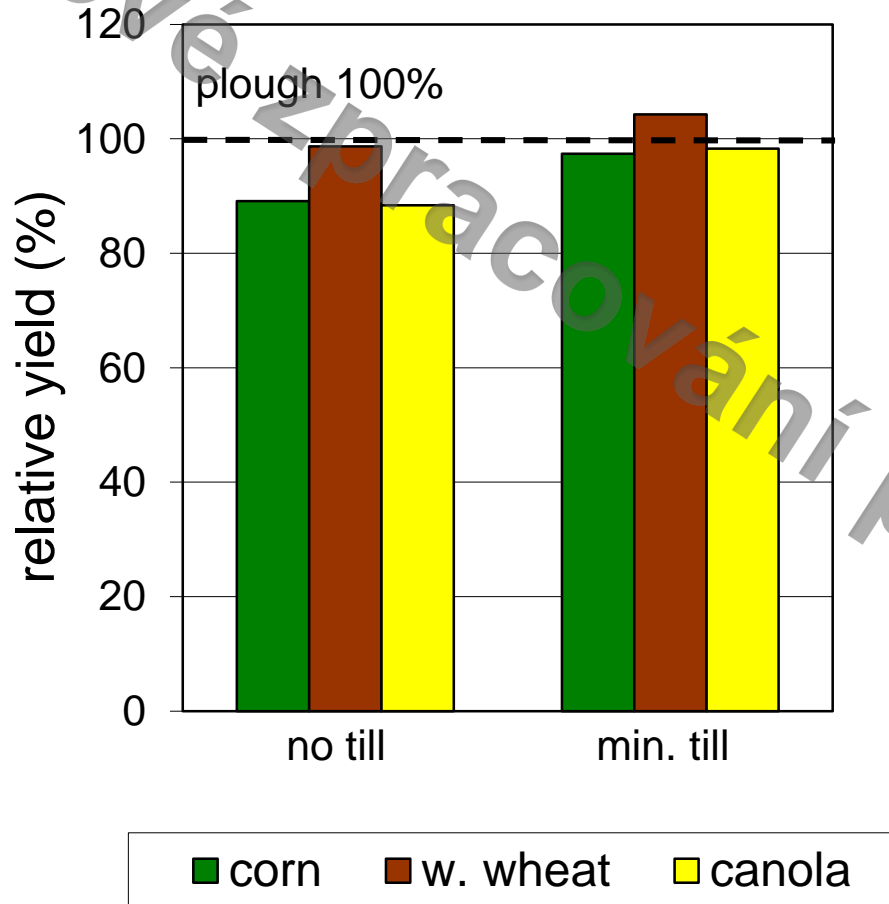
- If the soil structure is OK, then no yield decrease of minimum tillage
- plant protection is a challenge: resistant weeds
- fusarioses of wheat after corn: only efficient methods remains the plough



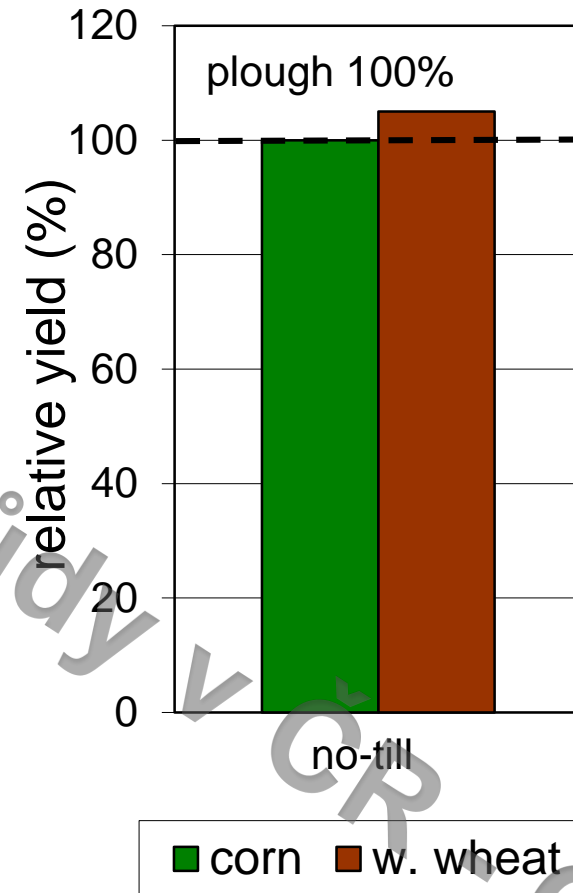


Relative yields in long term trials

Tänikon (1987-2006)



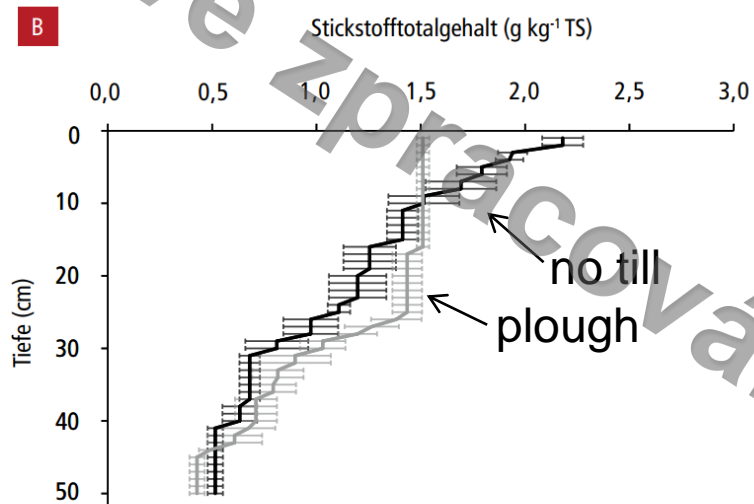
Oberacker (1994-2014)



(www.no-till.ch)

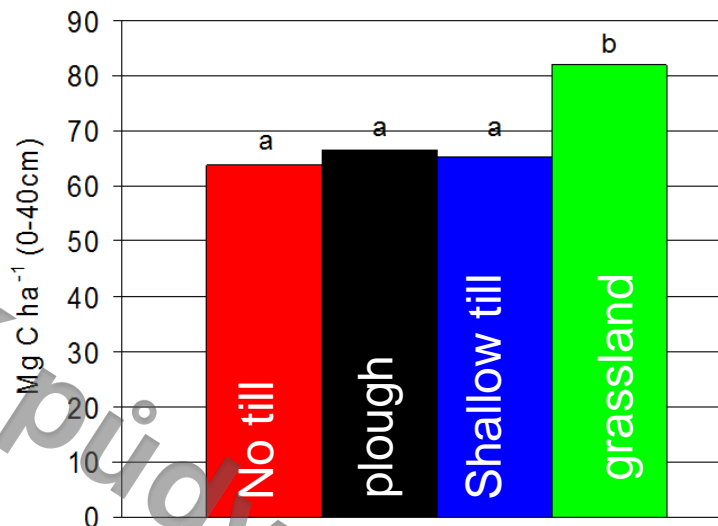
Organic carbon of different tillage systems after 20 years

Trial Oberacker (canton Bern)



Chervet et. al. 2016.
Agrarforschung Schweiz

Trial Agroscope Tänikon

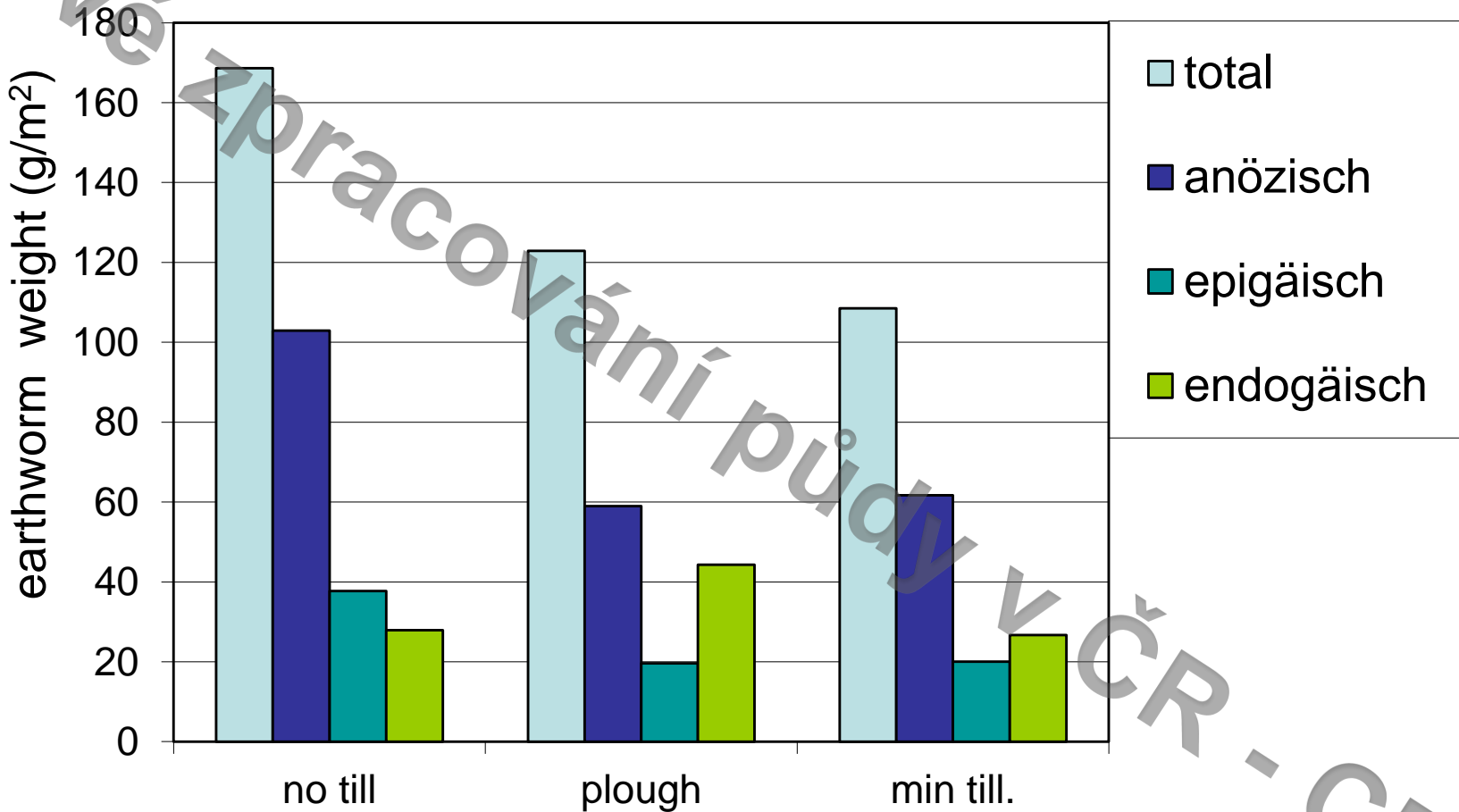


Hermle et al. 2008. soil & tillage research

→ no differences in C-sequestration caused by different tillage systems

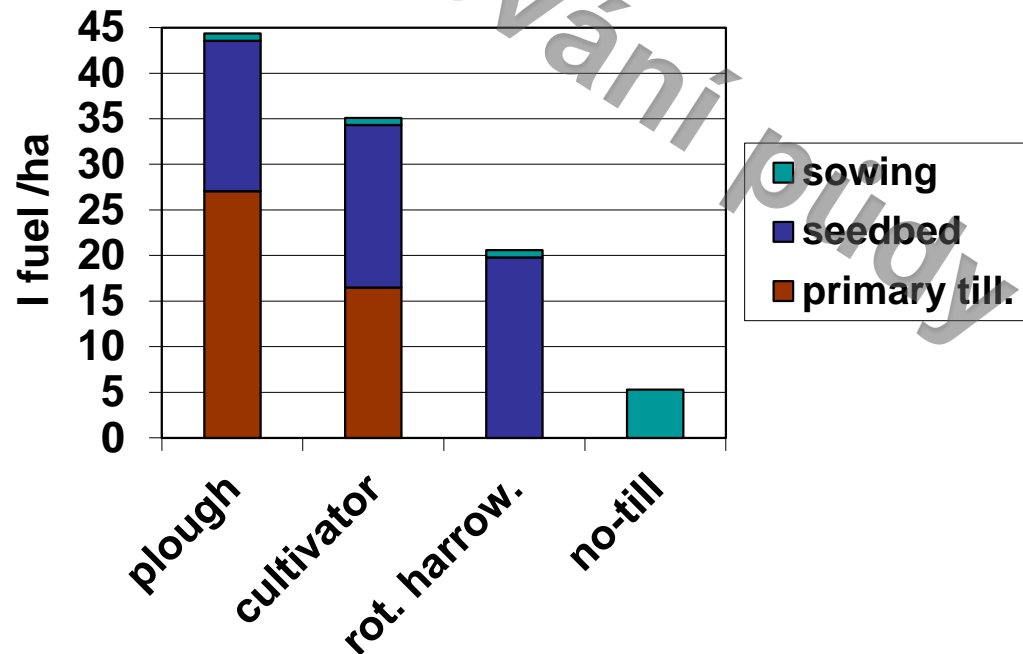


Earthworm weight Tänikon 2005

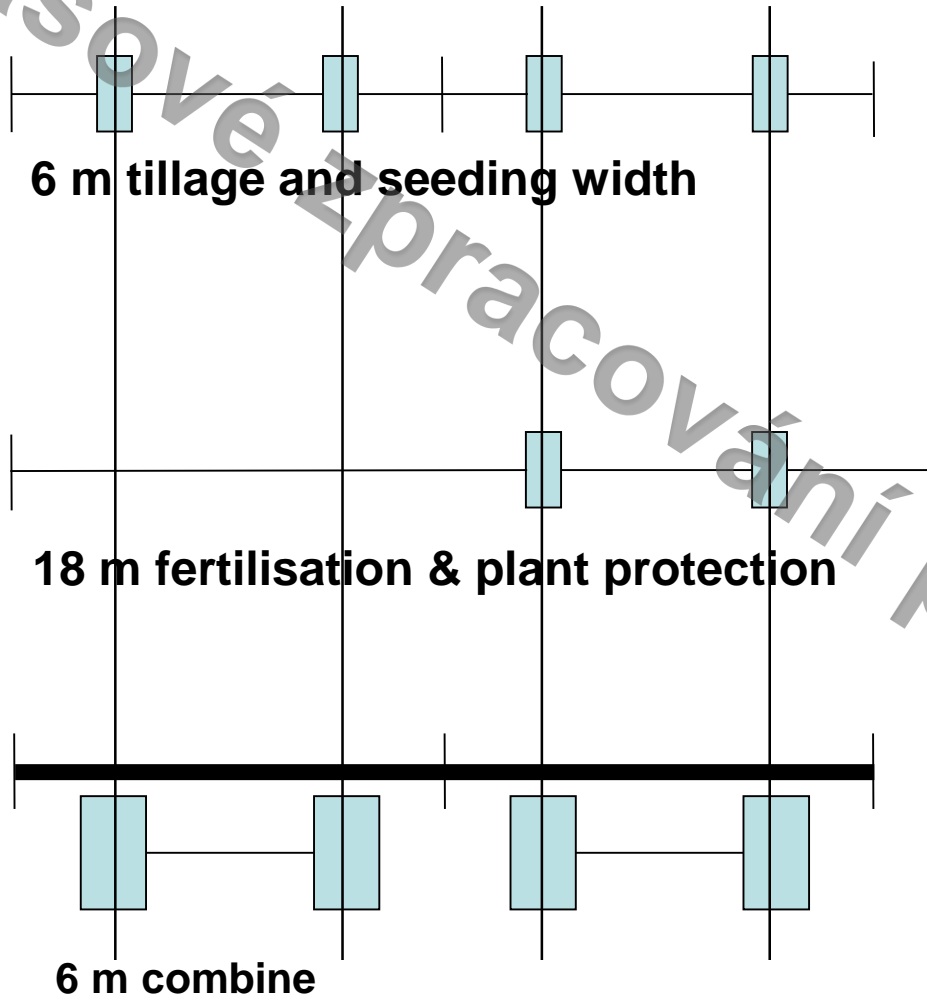


🇨🇭 Saving energy - less compaction instead of more tillage

- soil compaction of heavy machines
 - deep tillage to loosen compacted areas
 - Intensive seedbed preparation
- ➔ high costs and energy use



Controlled traffic farming



➔ All operations on the same tracks

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[Animation](#)



no track

-

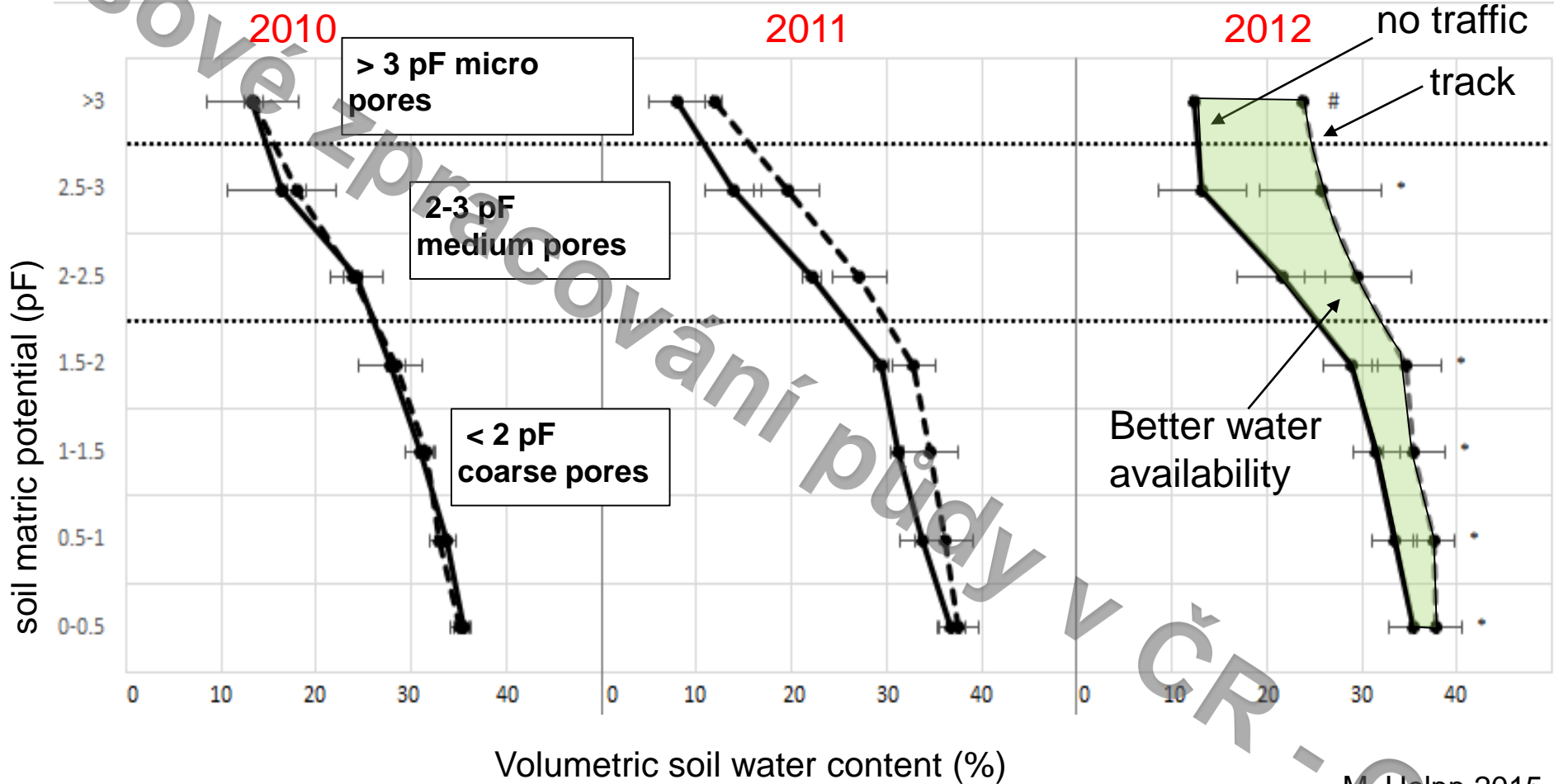
in track



Good soil structure allows plants to grow efficiently: root resistance, water and nutrient availability



Increased porosity and water availability in Tänikon (loam)

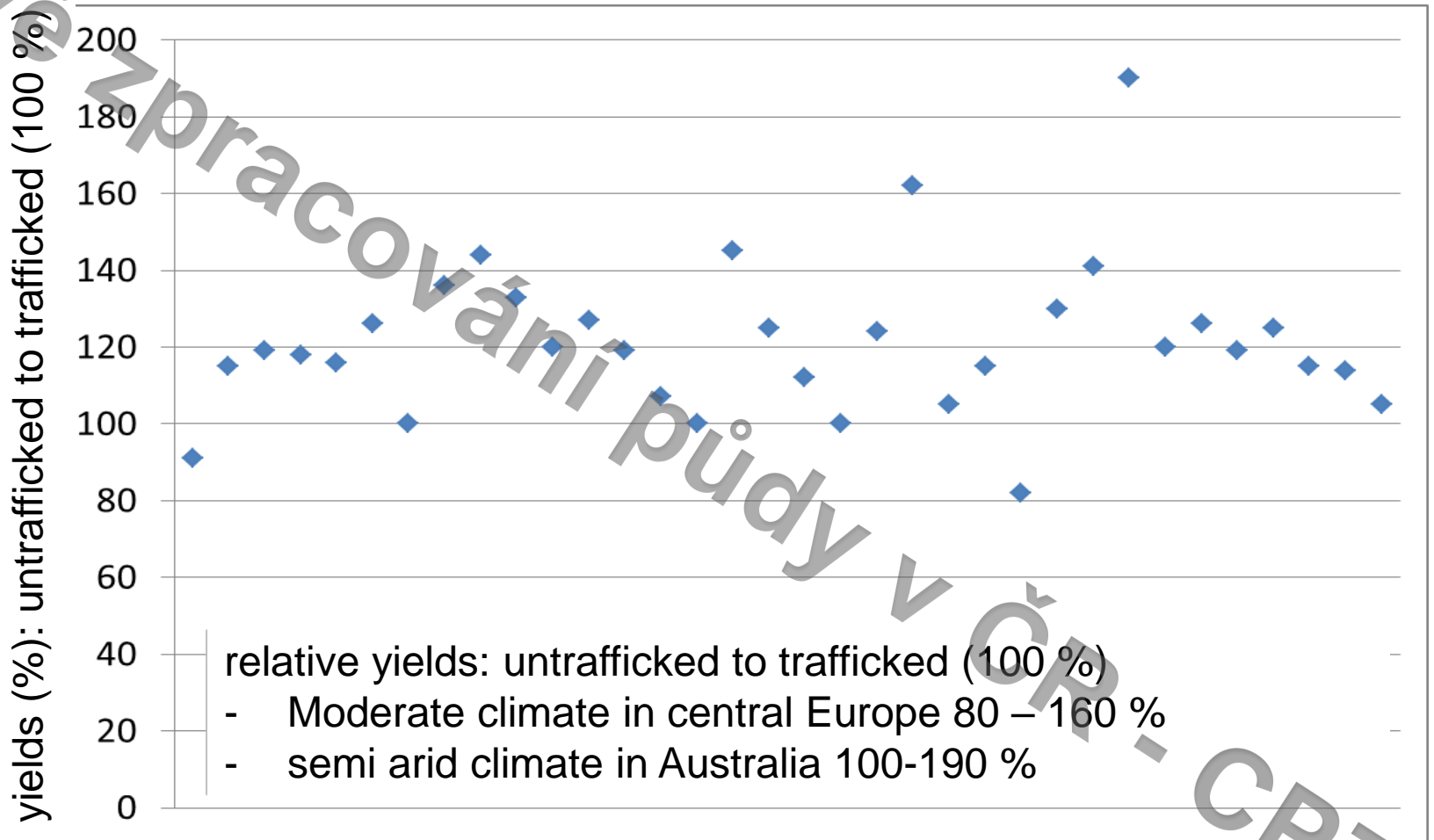


→ no-tillage

M. Holpp 2015



Yields of untrafficked areas compared to 21 publications from 1978 – 2003

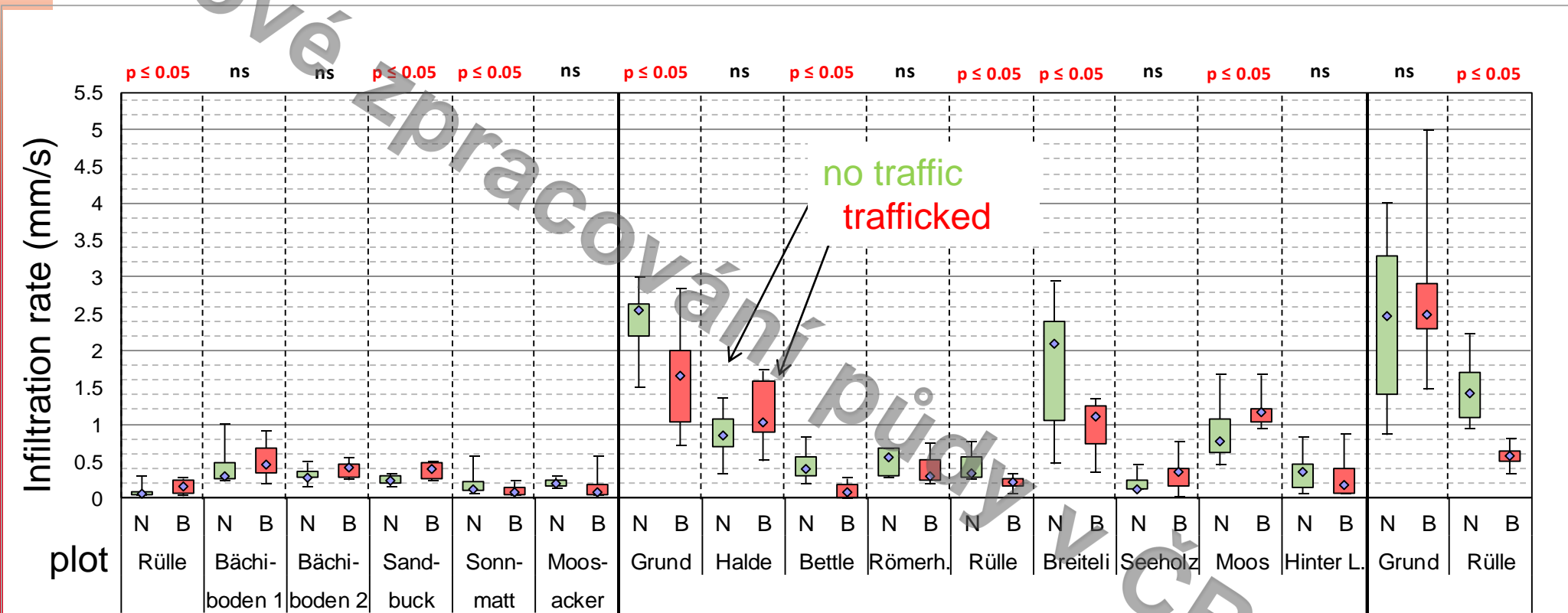


Source: Tim Chamen



CTF-Study Switzerland 2014-2017

Infiltration rates of trafficked and untrafficked areas, 17 plots



no tillage

minimum tillage

plough

(Latsch A. et al. 2017)

Swiss CTF-study – conclusions: CTF - conventional

	location		penetration resistance	infiltration rate	yield
no. till.	Kreuzlingen	Rülle-DS	0	0	+
	Marthalen	Bächiboden 1	0	0	0
	Marthalen	Bächiboden 2	++	0	+
	Marthalen	Sandbuck	0	0	0
	Rubigen	Sonnmatt	0	++	0
	Rubigen	Moosacker	++	++	+
min. till.	Tänikon	Halde	0	0	0
	Kreuzlingen	Rülle-MS	0	++	++
	Winterthur	Breiteli	++	++	0
	Watt	Seeholz	0	0	0
	Thunstetten	Moos	0	0	0
	Thunstetten	Hinter Lüthis	0	0	++
plough	Tänikon	Grund-PF	0	0	0
	Kreuzlingen	Rülle-PF	++	++	++

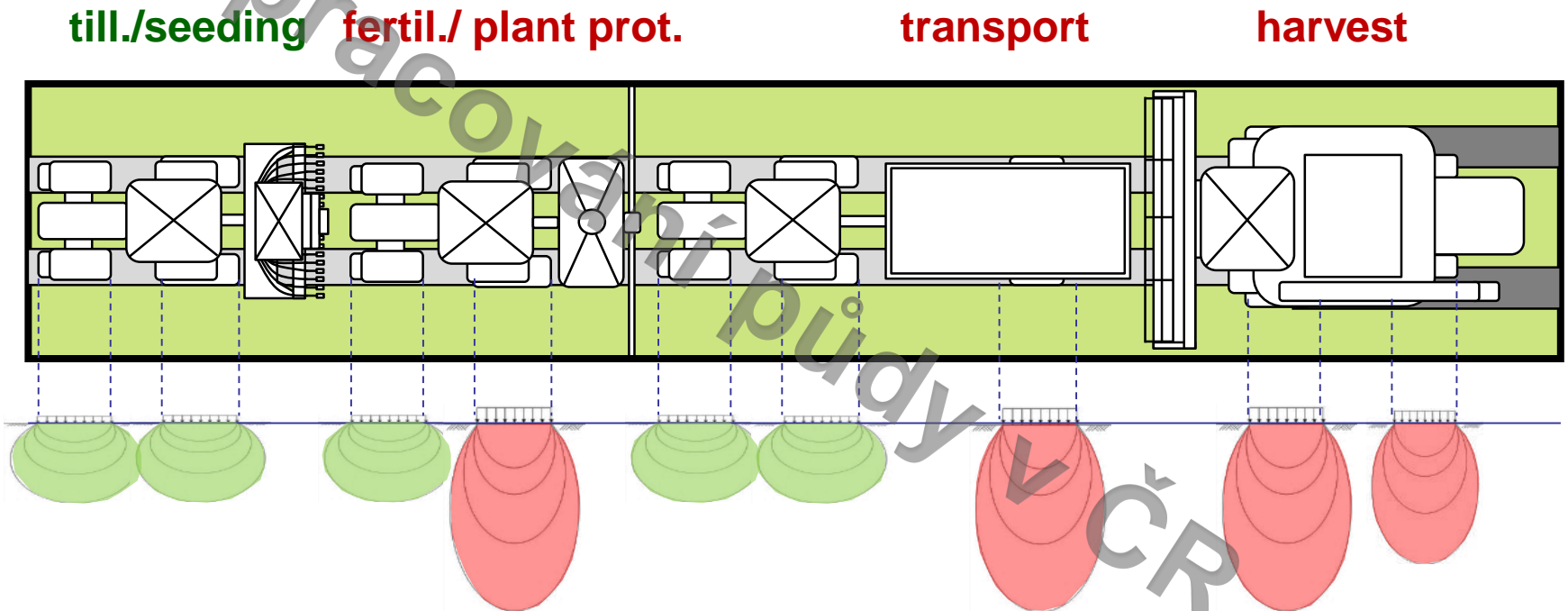
+ / ++ = positive effect
 0 = no effect of CTF

(Latsch A. et al. 2017)



Which are the critical operations? → CTF-light

- Fertilisation & Spraying: 3-point coupled machines
- harvest and transport



calculations: www.terranimoch

Swiss special: Rotary band seeding of corn and canola

Goal: good crop emergence, increased soil temperature, soil aeration, N-mineralization

→ About 40 % of corn is tilled with this system



Rotary band seeding of corn (75 cm) row width



Double row for canola
(double rows 75 cm row width)

Strip-till – little success because of seedbed fineness



Not successful for corn after meadows
→ very rough seedbeds

Some success for sugar beet:

- strip tillage in autumn
- seeding in spring → frost creates fine seedbed





Pásové zpracování

B. Hug Marthalen

Pások

B. Hug Marthalen

Robotic weeding?

Ecorobotix - Startup in Yverdon, Switzerland

www.ecorobotix.com

- weed regulation in sugar beet and corn
- commercialisation is planned end 2018
- big political debates are ongoing concerning water pollution in Switzerland: many rivers contain over 30 substances and partly over $0.1 \mu\text{g}/\text{liter}$



Thank you!



www.agroscope.ch