Evaluation of practical experiences on concepts of reduced tillage in organic farming in Germany

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Motivation for research into ploughless cropping in organic arable systems

- **Soil carbon storage**
- **Difference organic / conventional**
- **„Downfall of conventional agriculture“ (as predicted decades ago) not directly apparent**
- **Self regulation and productivity of organic systems: gaps**
- **Review organic theories of soil fertility**
- **Improvement of cropping systems**

On-farm research procedure

Identify organic farms without deep ploughing

⬇

Select 15 farms

(> 5 years without plough & organic)

⬇

Interviews and research over 2 years

⬇

Detailed analysis of farm plans and data

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Reasons given for not using deep ploughing

e.g.

- **Save fuel**
- **Faster**
- **Very shallow or very heavy soils**
- **Avoid plough pan**
- **Thistle problems**
- **Encouraging biological activity of the soil**
- **Conserving natural soil stratification**
- **Plant residues on the soil → more stable soil structure**
  - Reduced risk of soil erosion and soil capping
  - Increased infiltrability and water retention

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Tillage details on the participating farms

Group A: low depth	**maximal depth**	**Number of farms**
Ecomat	15 cm	1
Stoppelhobel („stubble plane“)	8 cm	2
Grubber (cultivator)	8-15 cm	3
EcoDyn	8 cm	1
Fräse / Kreiselgrubber (tiller / rotary cultivator)	7 cm	1
Group B: with subsoiling	**depth**	
Schichtengrubber + Zinkenrotor	35 cm	1
Kemink (ridge tillage system)	25 cm	1
Turiel (ridge tillage system)	15-35 cm	3
Frost (ridge tillage system)	30 cm	2

Dyna-Drive

Shallow tillage

Cultivator (Grubber) **(duck feet)**

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EcoDyn

Shallow tillage

Stoppelhobel („ Stubble plane“)

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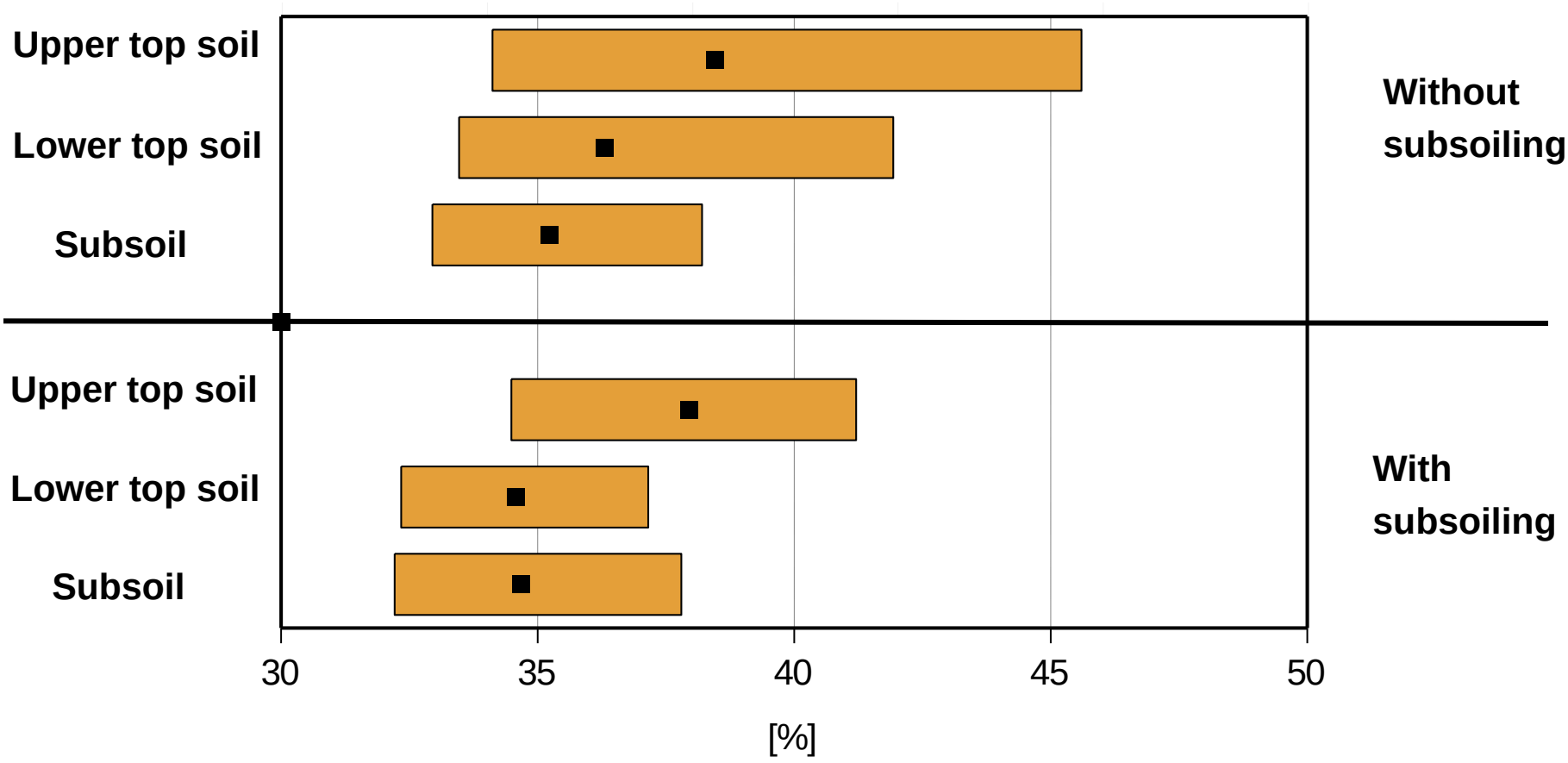
Ridge tillage system (Turiel)

Systems with subsoiling

Ridge tillage system (Frost)

Pore volume (Upper top soil, lower top soil and subsoil) (range & averages)



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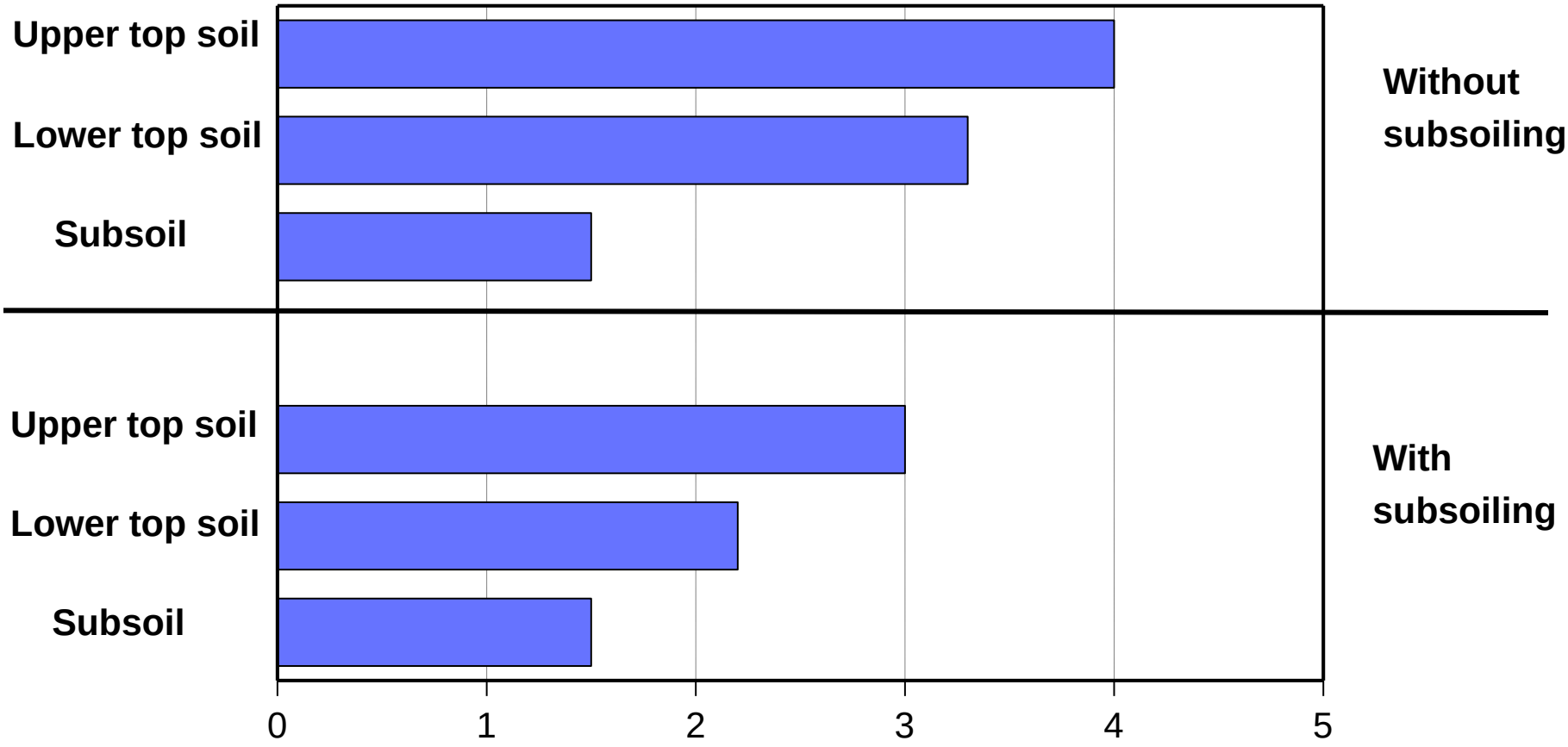
Organic matter (average)



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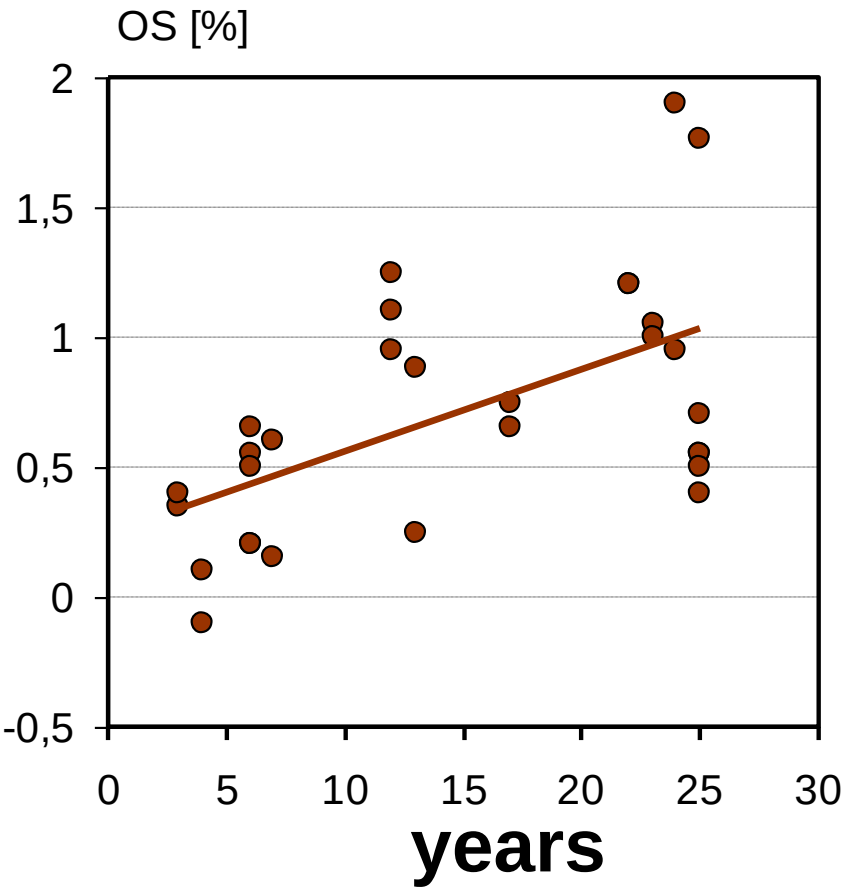
Difference of org. matter contents between upper and lower top soil

✚ **Factor: duration under reduced tillage**



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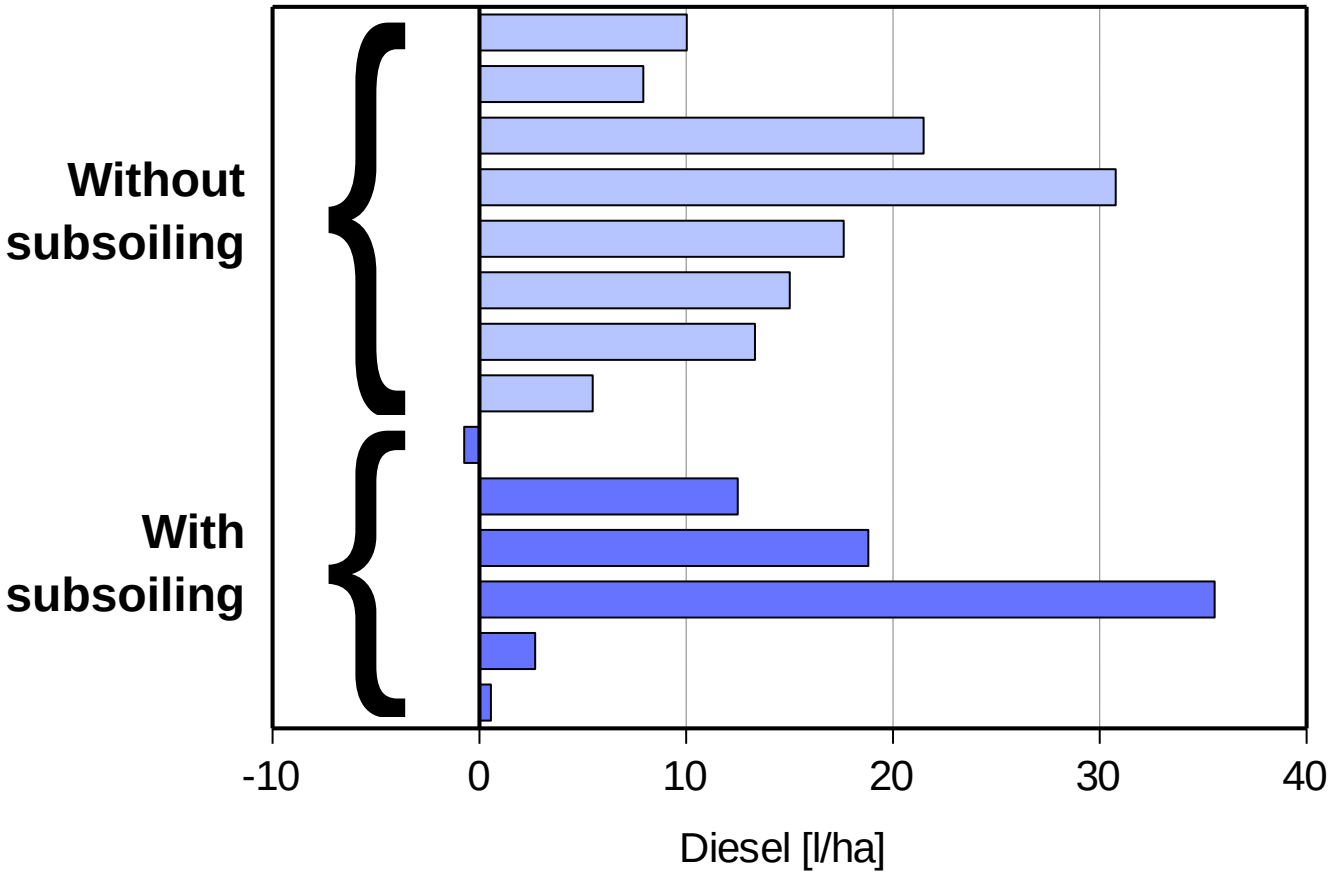
Average fuel saving per ha and year – comparison with (theoretical) plough system



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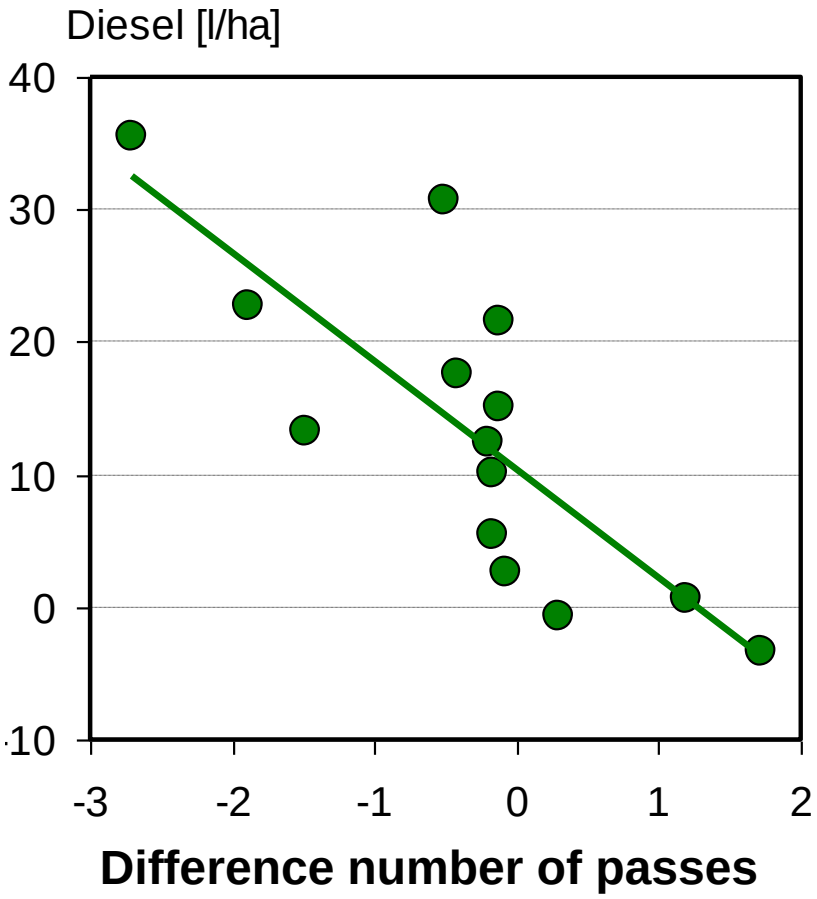
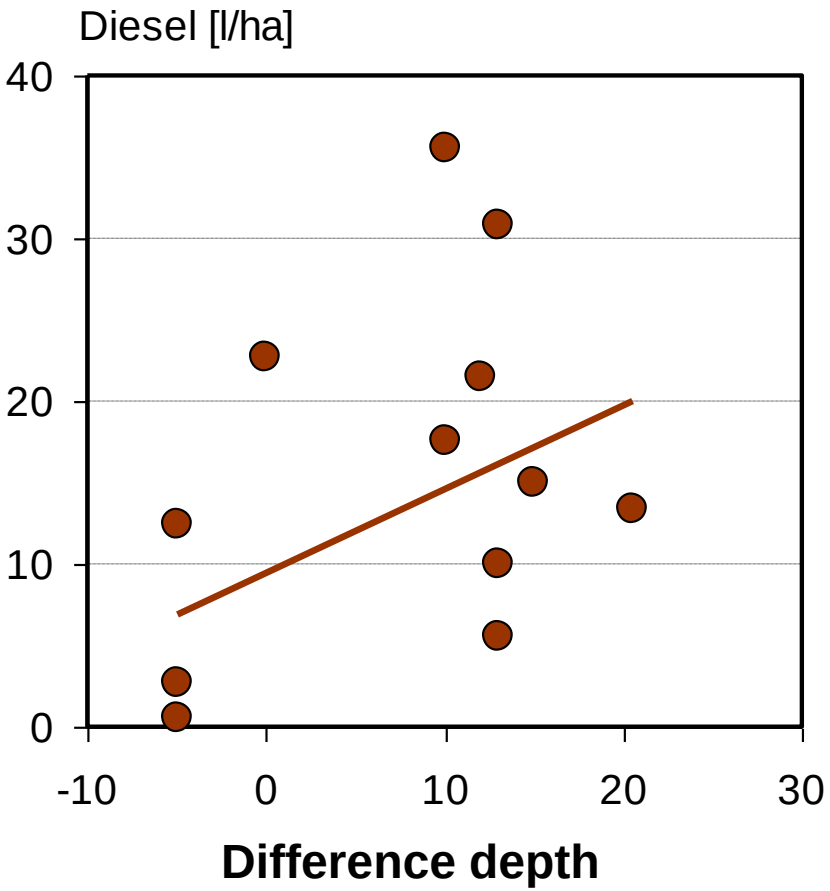
Average fuel saving per ha and year





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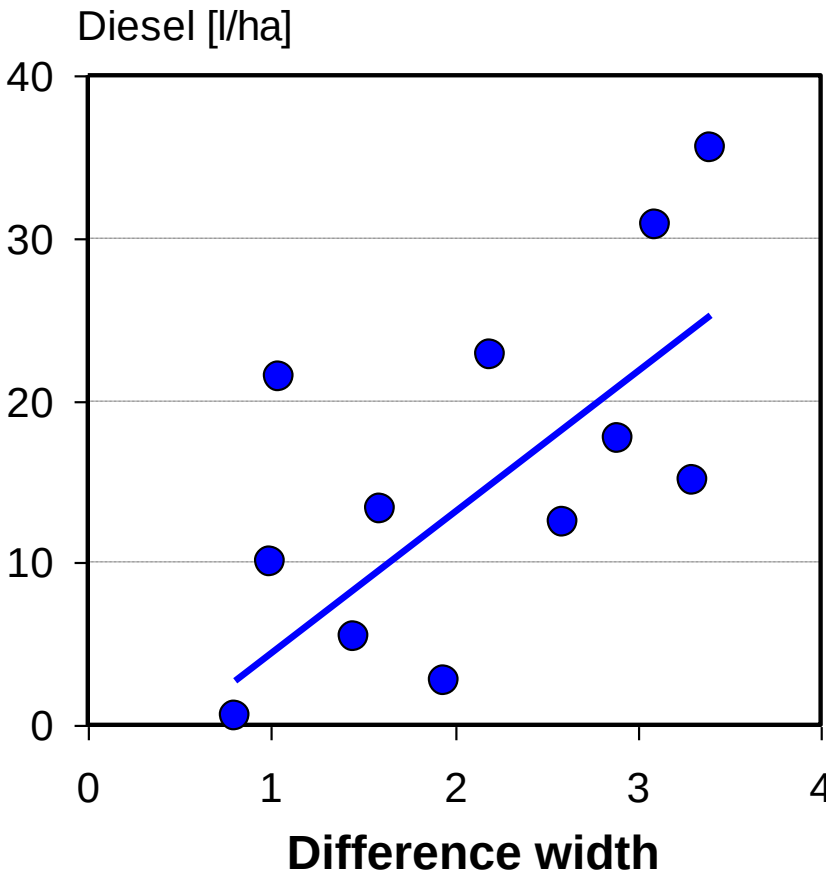
Average fuel saving per ha and year



Conclusions

- **Organic arable production without deep ploughing is possible**
- **Systems with reduced tillage often...**
  - **Are more demanding**
  - **Have positive effects on soil**
  - **Can Increase weed pressure**
  - **Result in somewhat lower yields**
  - **Can reduce diesel and other costs**

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Open questions:

e.g.:

- Energy use
- Long term development of weed pressure
- Long term development of soil structure
- Yields
- Economic aspects
- Plant nutrients
- diseases
- …

Ecomat

Tiefe: 15 cm

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Stoppelhobel

Tiefe: 5 cm

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EcoDyn

EcoDyn

Tiefe: 4 cm (10 cm-Schare)

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Dammkulturgeräte (Frost)

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Dammkulturgeräte (Turiel)