

Long term trials in Europe and North America: experience and research approaches

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Int. Workshop on Organic Farming and Development in China, held at China Agricultural University, Beijing



Raupp (2009)
www.ISOFAR.org

My background: research and international co-operation

- IBDF, Institute for Biodynamic Research

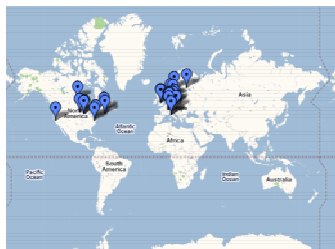


- ISOFAR, www.ISOFAR.org : working group for Long-term Experiments

Introduction Research approaches Key results Benefits Drawbacks Summary Raupp (2009)
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Long-term field studies on organic farming (25):

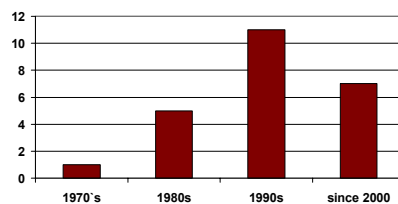
- Austria (1)
- Canada (3)
- Denmark (2)
- Finland (1)
- Germany (6)
- Italy (2)
- Sweden (1)
- Switzerland (1)
- United Kingdom (2)
- United States of America (6)



- Probably, there is a number of other trials that are not shown.

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When did these field studies start ?



- 11 experiments (46%) are carried out for more than 15 years
→ 231 experimental years

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Research approaches:

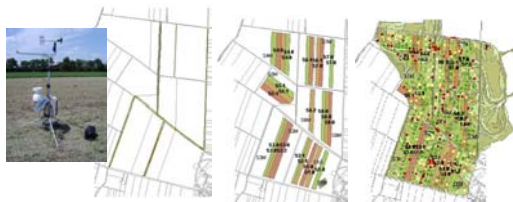
- Experiments with field plots and factorial design (22)
- Farm studies (3)



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Research approaches: farm study

- Landscape monitoring, e.g. hedges
- Fertilisation trial
- Farm area

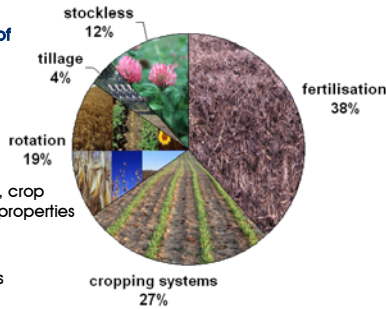


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Research approaches: main research subject of the experiments

- Nutrient management, crop performance and soil properties are most important.

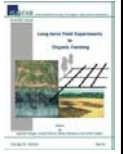
→ Sustainability indicators



Key results:

Effects of organic vs. conventional systems or of organic vs. mineral fertilisation:

- organic carbon (C_{org}), microb. carbon (C_{mic}): >
- soil bulk density: <
- soil dehydrogenase activity: >
- $qCO_2 = CO_2 : C_{mic}$: <
- crop yields: < or > or = depending on crop and situation



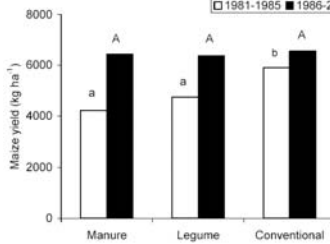
Results on crop yield, example 1: The Farming Systems Trial (since 1981)

Comparison of 3 cultivation systems:

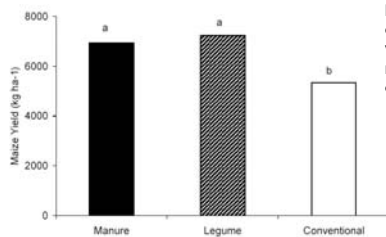
- organic / manure-based
- organic / legume-based
- conventional



Maize yield (kg ha⁻¹) in the conversion period (1981-85) and later (1986-2001) in 3 cropping systems



Hepperly et al. (2006)



Maize yield (kg ha⁻¹) on average of 5 drought years (<350 mm vs. 500 mm precipitation) with 3 cropping systems



Hepperly et al. (2006)

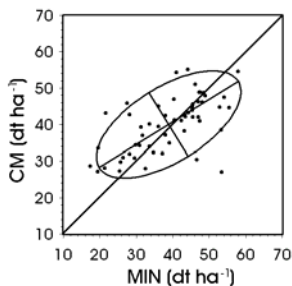
Results on crop yield, example 2: The Fertilisation Trial Darmstadt (IBDF) (since 1980)

Comparison of 3 fertilisers:

- CM: composted manure
- CMBD: composted manure + biodynamic preps.
- MIN: mineral fertilisers



Correlation between spring wheat yields with composted manure (CM) and mineral fertilizer (MIN); results of 4 replicates and 14 years (n=55)



Confidence ellipse ($p < 0.05$):

major axis regression:

$$Y1 = 15.96 + 0.62 Y2$$

slope (b):

$$0.416 < b < 0.868$$

Raupp (2001)

Long-term experiments are essential for the assessment of

- sustainability
- biodiversity
- effects on climate change (carbon budget, GHG emission)
- effects on nature and landscape

→ In all these fields, organic agriculture wants to achieve the targets to the highest possible degree.

→ Organic agriculture needs long-term experiments to evaluate and to improve its methods.



Some inherent drawbacks of long-term experiments (LTEs):

- LTEs are relatively capital-intensive and labour-intensive;
- they occupy capacity (area, machinery) for a long time;
- fixed cost (usually not covered by project grants).
- LTEs are less flexible to deal with new questions (agricultural, scientific, social).
- LTEs are no optimal basis to obtain a high ranking scientific or academic merit;
- some years are needed to establish the experimental system;
- who pays for the start-up phase?



"Wisely used, long-term experimental sites provide information on the long-term sustainability of agricultural systems that can be obtained in no other way."

David S. Jenkinson, 1991



Thanks I

- Many thanks for your attention!
- Many thanks to CAU and ICROFS for inviting me!

