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

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My background: research and international co-operation

- IBDF, Institute for Biodynamic Research

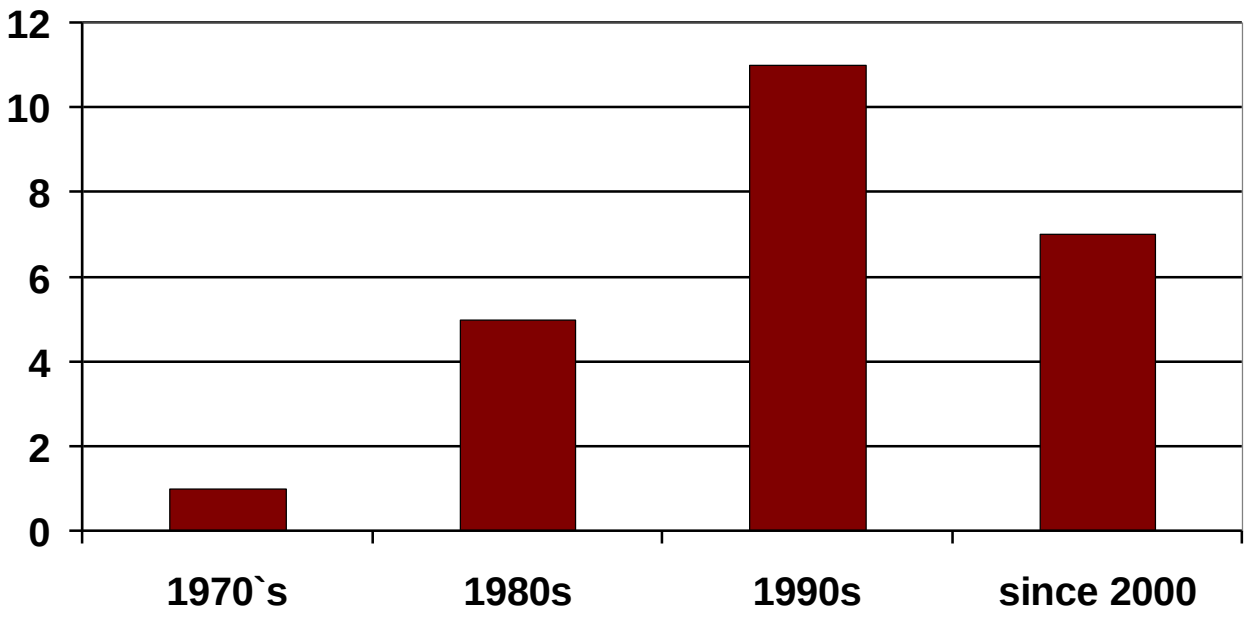
- ISOFAR, www.ISOFAR.org : working group for Long-term Experiments

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)
Unites States of America (6)

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

When did these field studies start ?



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

→ 231 experimental years

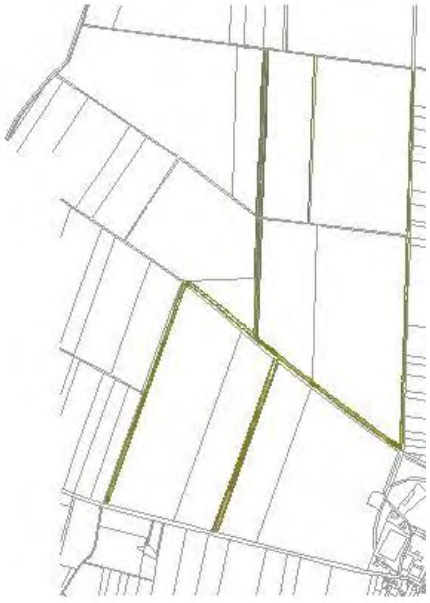
Research approaches:

- Experiments with field plots and factorial design (22)

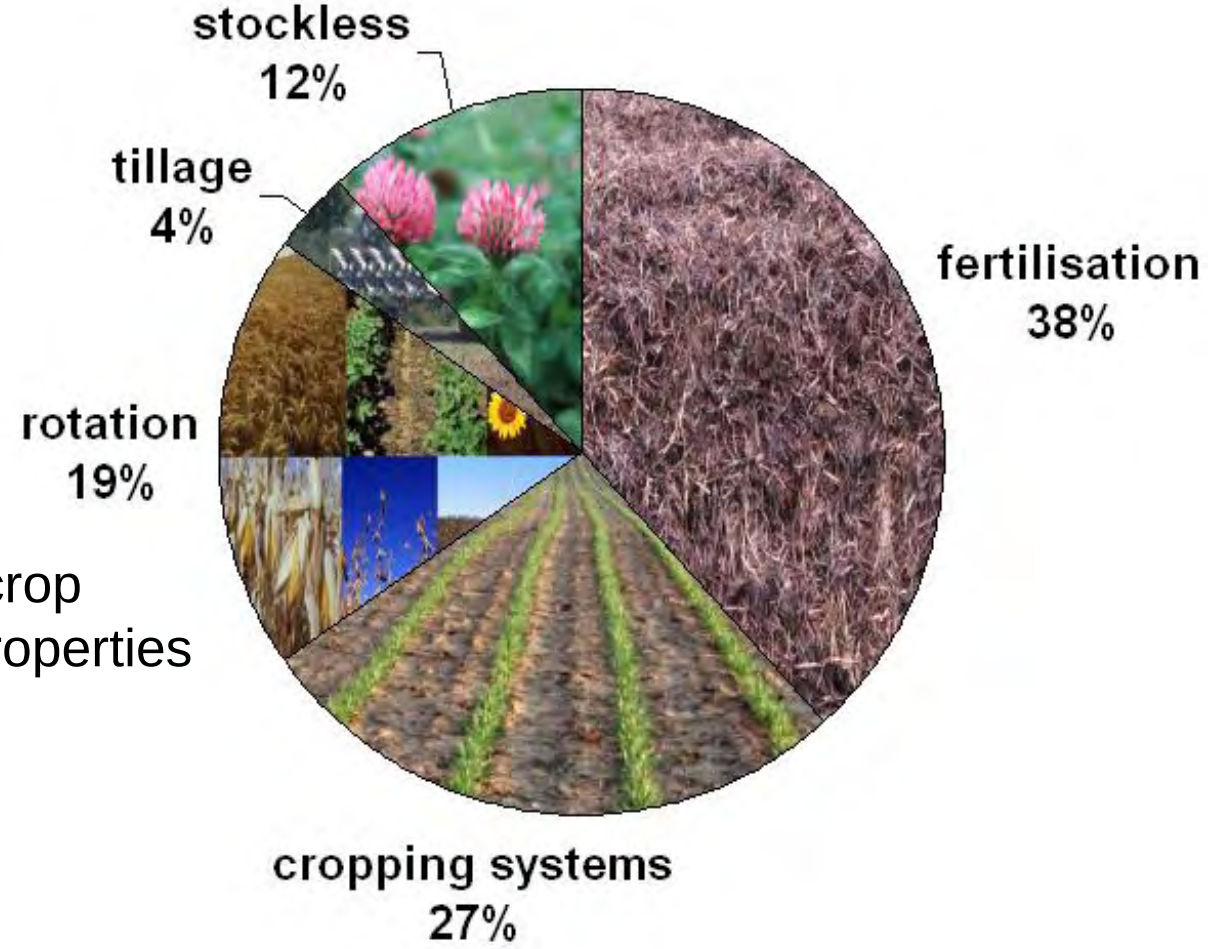
- Farm studies (3)

Research approaches: farm study

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



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

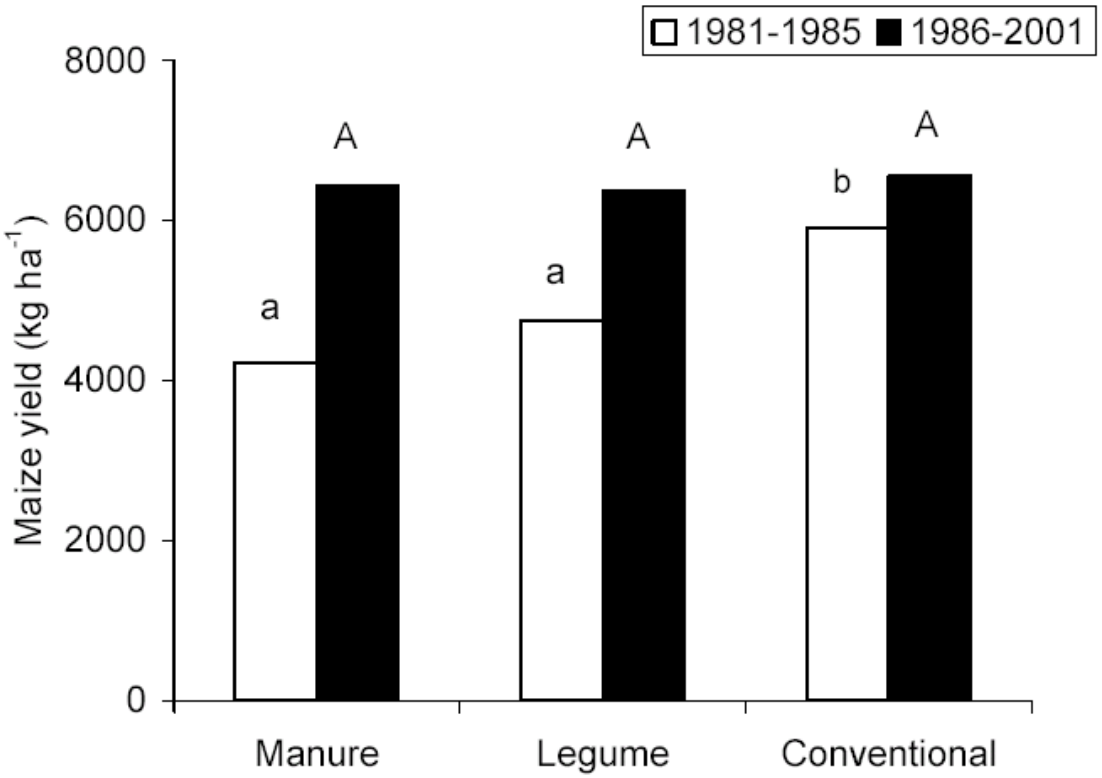
Results on crop yield, example 1:

The Farming Systems Trial

(since 1981)

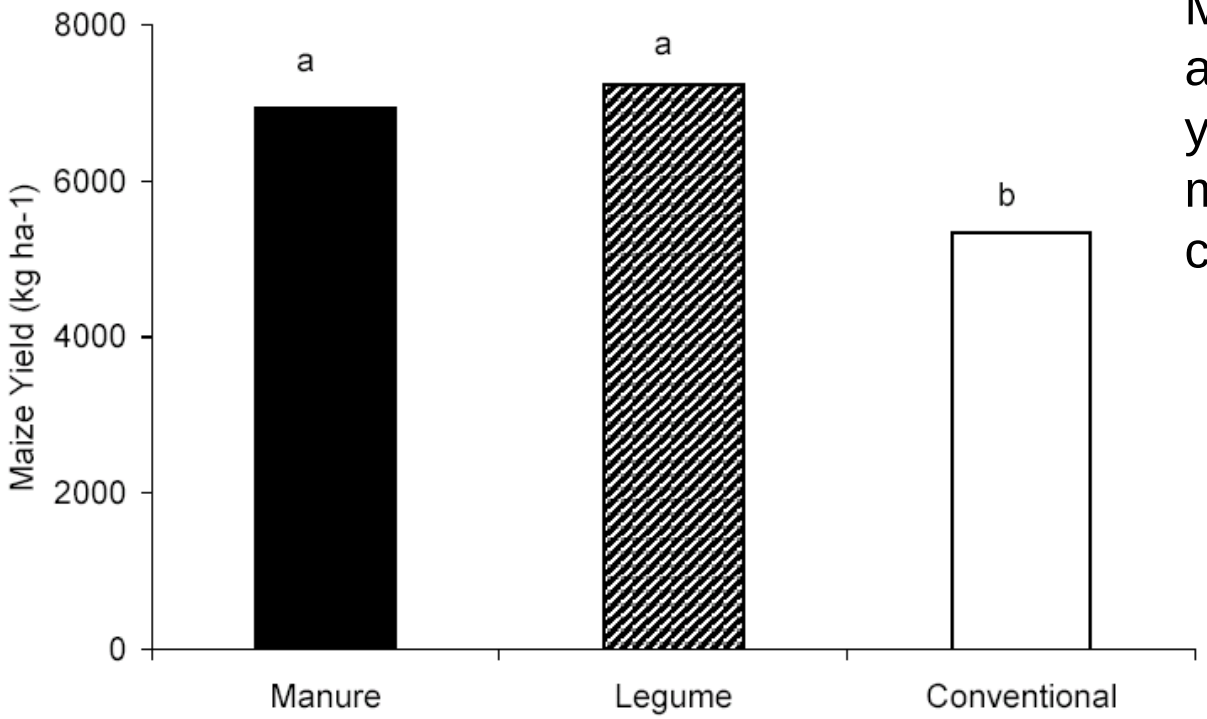
Comparison of 3 cultivation systems:

- 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)

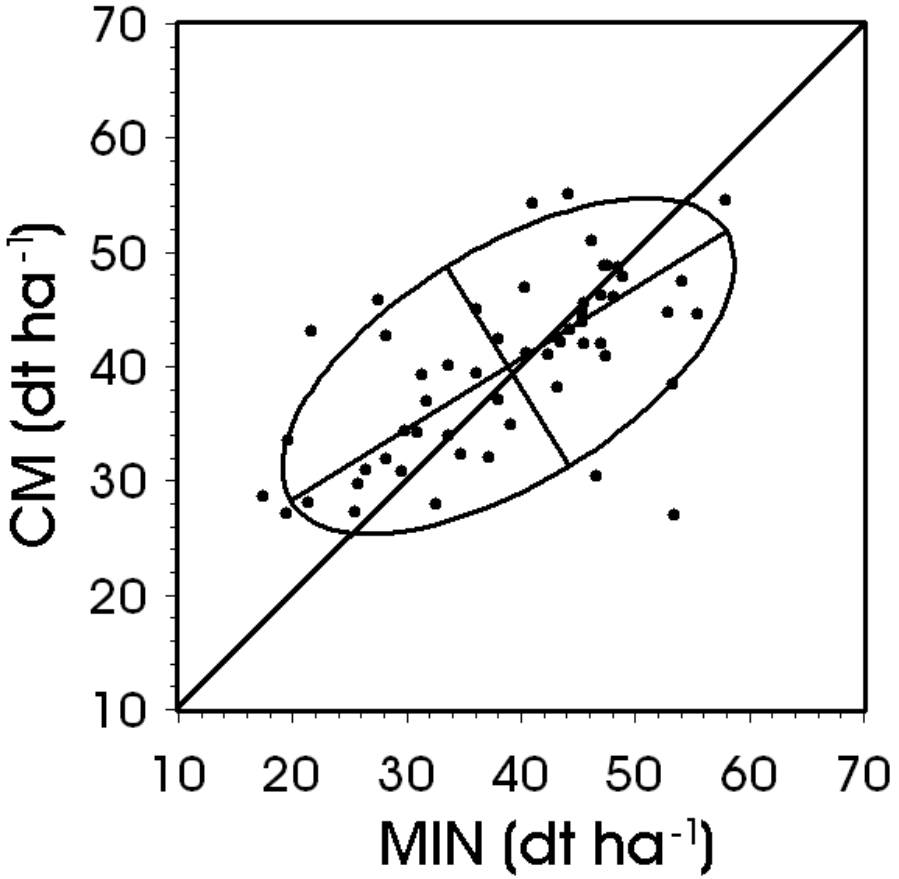
Results on crop yield, example 2:
The Fertilisation Trial Darmstadt (IBDF)

(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 !

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