Redesigning Long Term Systems Experiments in the Netherlands

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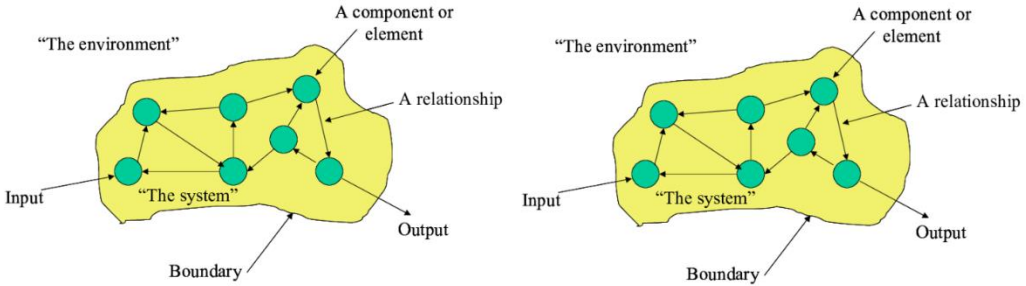
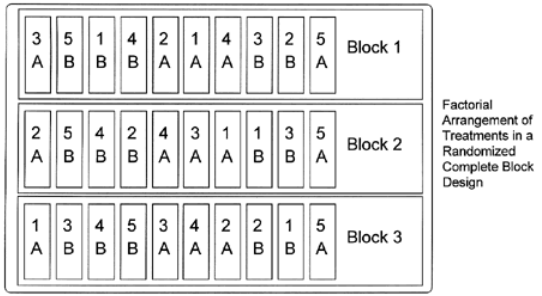
100years
1918 — 2018

BETER
BODEMBEHEER

Systems research – Factorial research



- Designing & testing system to set of performance objectives
- Consistency within context
- Certification & demonstration
- Only conclusions on the whole system, not on factors
- Location effect not known



- Quantification of effect of each factor
- Trade-offs between factors
- Scientific publications
- Risk of "non-relevant" systems or results

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Long term system experiments in the Netherlands focus on soil management

Soil Quality on peaty soils (SQP), Valthermond, 2013

Broekemahoeve Applied Soil Innovation Systems (BASIS), Lelystad, 2008

Soil Quality on Sandy Soils (SQS), Vredepeel, 1989, current set up since 2001

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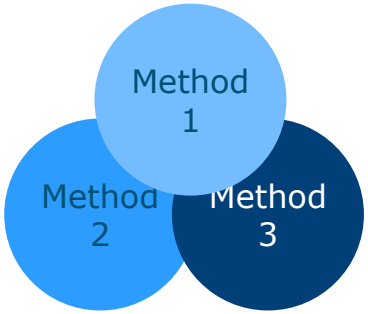
Continuation of long term system experiments?

Societal Challenges



(New) solutions available

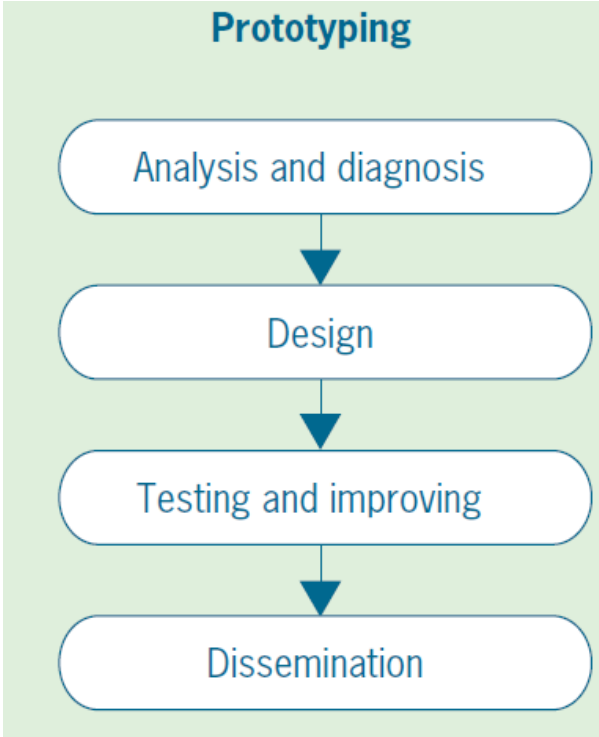
Current experiments and additional use

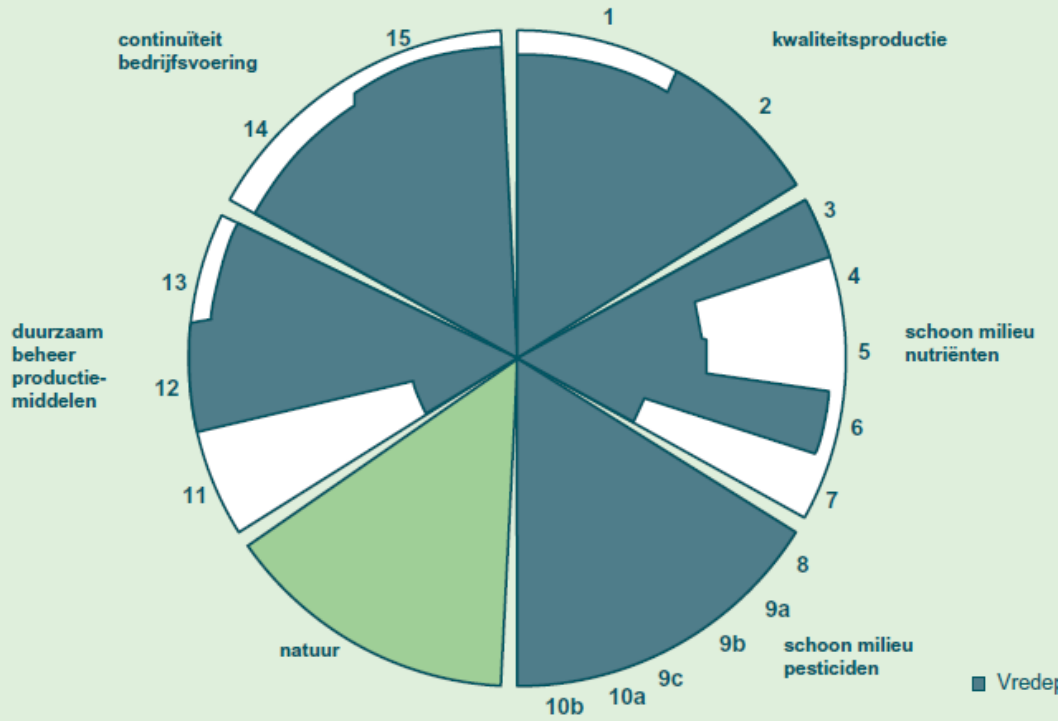
Continuation as before

Start new experiments

Adaptation of experiments

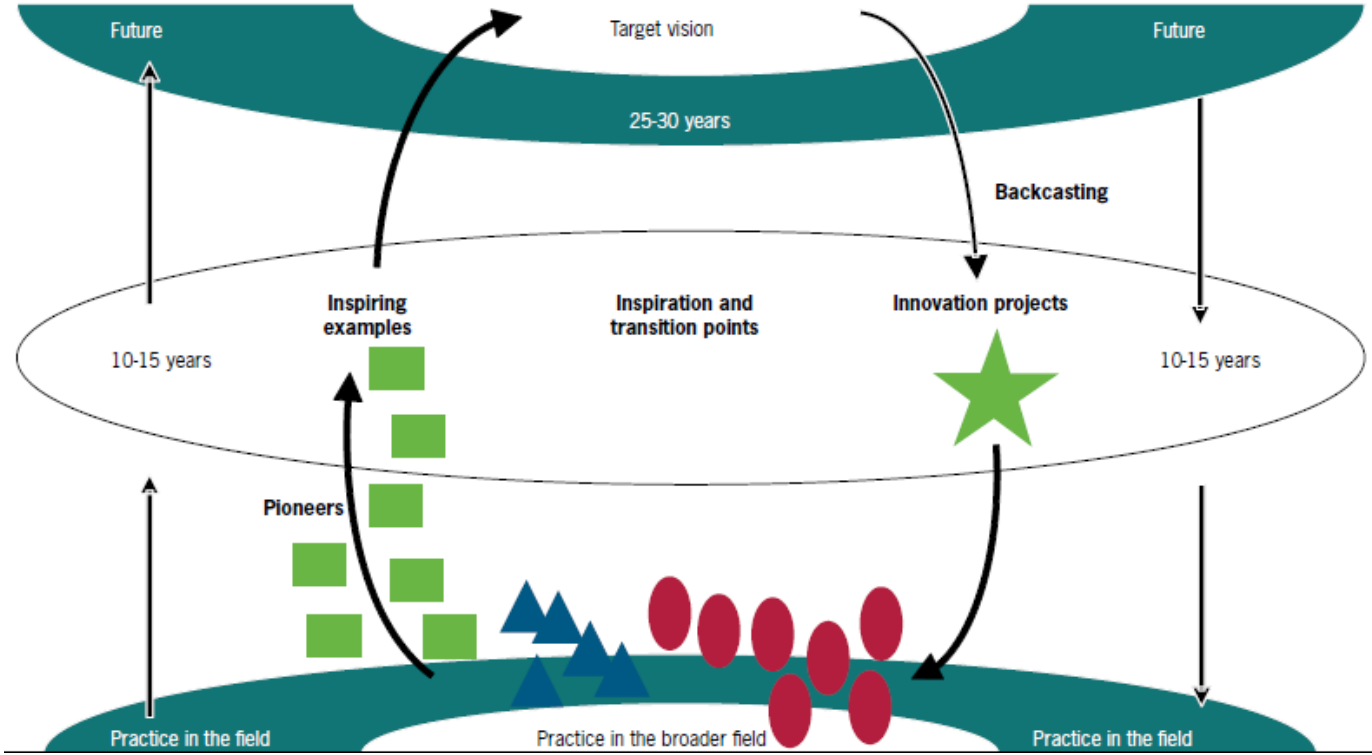
1980-2000 Farming systems research





Vereijken 1992, Vereijken 1999, Wijnands & Backbier, 2002, de Haan & Garcia Diaz 2002

2000-2010 System transitions



Meijer et al. 2011

2010-2020 Long term effects of soil management

Soil management options

Ecosystem services

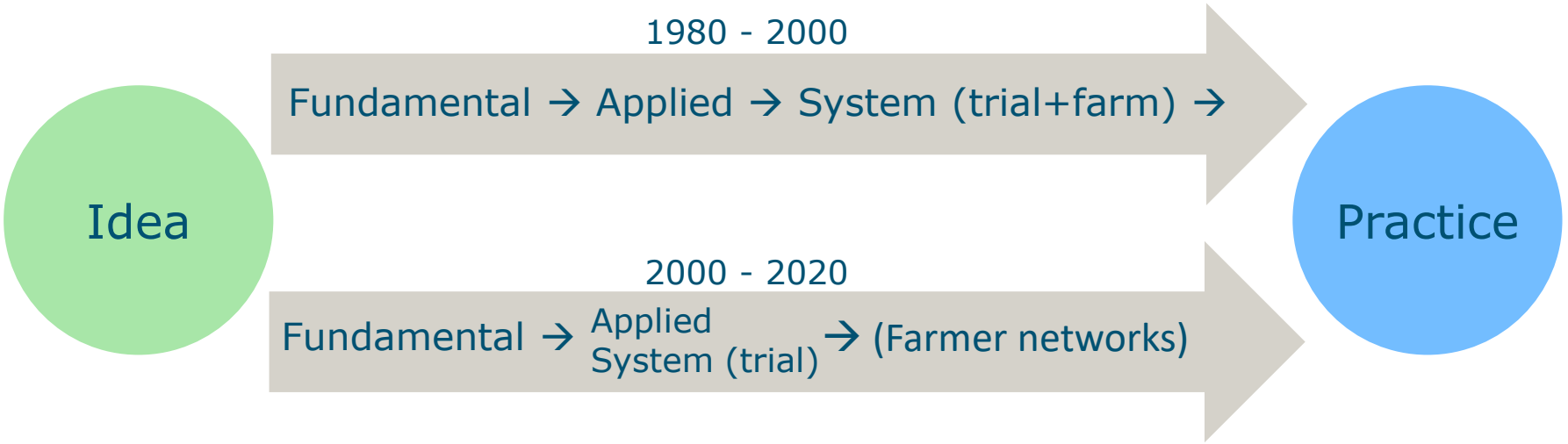
Soil quality

Typology of research periods

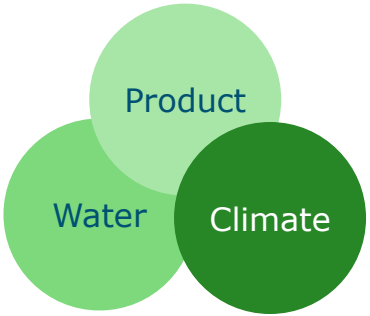
based on Lechenet et al. (2016)

Period	Type of research	Research orientation	Experimental design	Management	Replicates
1980-2000	Farming systems research	Applied	Systemic	Iterative	Temporal
2000-2010	System transitions	Prospective	Systemic	Iterative	Temporal
2010-2020	Long term effects of soil management	Patrimonial	Systemic & factorial	Iterative but more fixed	Temporal and spatial

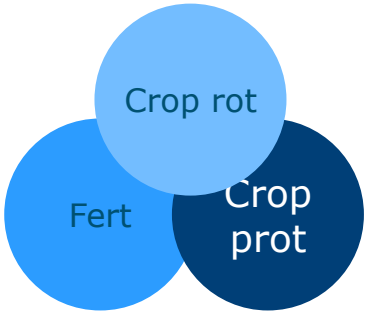
Research from idea to practice



Continuation of long term systems experiments?



Societal Challenges



(New) solutions available

Current experiments and additional use

Continuation as before

Start new experiment

Adaptation of experiment

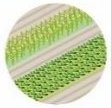
Agro ecology & Technology Test Location Lelystad

Buiding blocks


Landscape elements


Cover crops


Organic matter input


Strip cropping


Robust varieties


Reduced tillage


Agroforestry


Small machines


Mixed cropping


Crop Rotation


Controled traffic system


Legumes

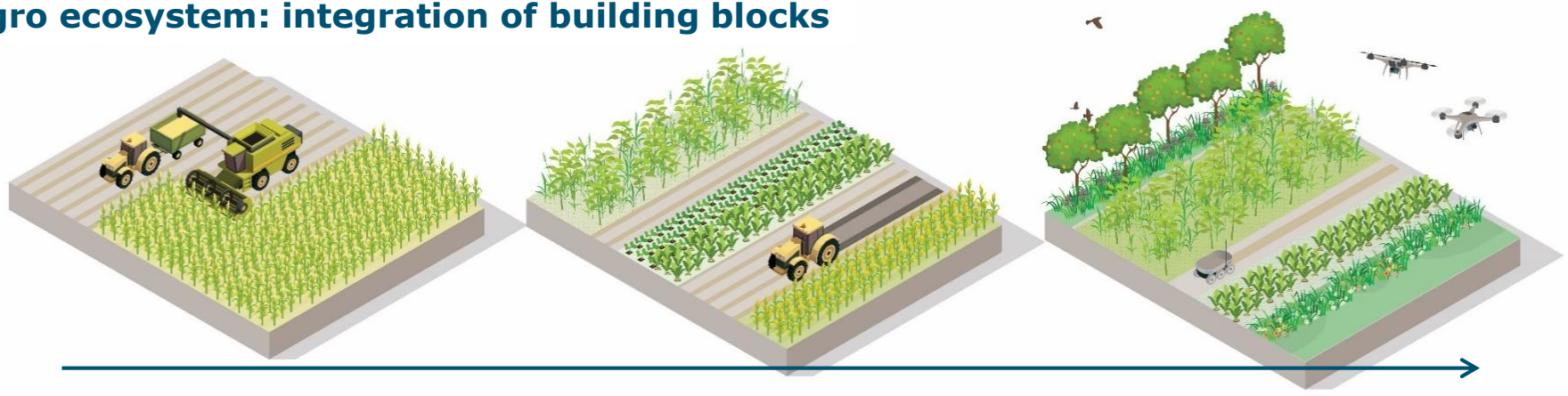

IPM 2.0


Natural enemies


DSS


Detection & monitoring

Agro ecosystem: integration of building blocks



Agro ecology and Technology Test Location

BASIS: Soil management

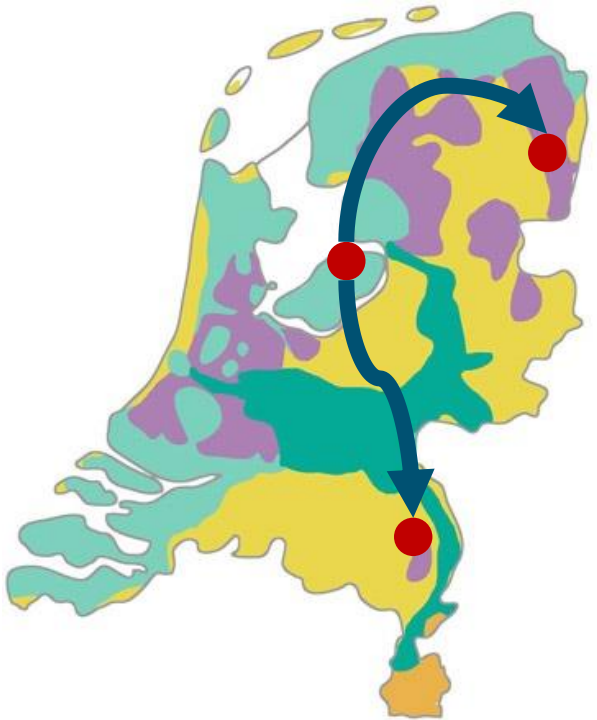
Green crop protection

Strip cropping

foforestry

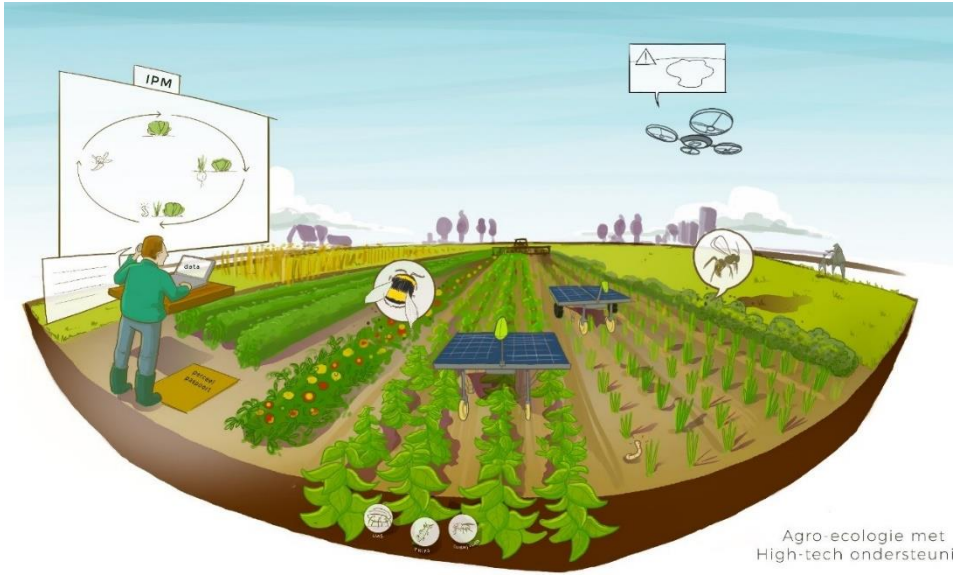
Methodological aspects

- Connect experiments in design
- Combine with other research methods
    - Field trials, modelling, LCA's
    - Cooperation with other researchers
- Full assessment of system performance
- Involve stakeholders in whole process
- Start dissemination from beginning



To conclude

- Exciting period in front of us
- Combining value of current experiments with
    - new questions with
    - (new) tools with
    - new experiments with
    - other research with
    - stakeholders



→ Cooperation essential: building a research ecosystem

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Sustainable Farming is top sport
No sprint, no marathon, but a decathlon

Thank you for your attention

and the farmer, he plowed forth (Dutch saying)

While the questions keep growing: Crop production faces many challenges

- Stable production level of high quality
- Pest & disease management
- Climate mitigation (carbon sequestration)
- Climate adaption
- Soil quality
- Water quality (nutrient leaching)
- Biodiversity
- Resource use efficiency

System research needed but difficult

- Multi objective questions
- Consistent designed systems needed

- Factorial research can not give the answers alone

- Designing and testing systems difficult
- Excellent agronomy needed
- Principles more important than final result

Reflection on experimental setup SQS

- Dislocation of organic and conventional systems draw back
  - Leaving certification of organic system?
  - Research questions on applying conventional farming in organic fertilization strategies
- Differences in crop rotation reduced as much as possible
  - No solution to above problem but reduces uncertainty
- Room for detail experiments present but under used
  - money, cooperation, complexity

Reflection on objectives and results SQS

- Current hypotheses have been investigated sufficiently?
  - Organic matter dynamics not in equilibrium
  - Current soil tillage strategies do not give differences
  - No full rotation after latest major changes in experiment
- Valuable management contrasts used in various other research
  - Development of soil biology measurements
  - Effects on nitrogen and carbon dynamics
  - Greenhouse gas emissions
- New questions emerge: biodiversity, climate, circular agriculture
- No picture of overall performance of systems