PERFORMANCE OF CIRCULAR SOIL MANAGEMENT MEASURES:

RESULTS FROM FOUR LONG-TERM EXPERIMENTS IN THE NETHERLANDS

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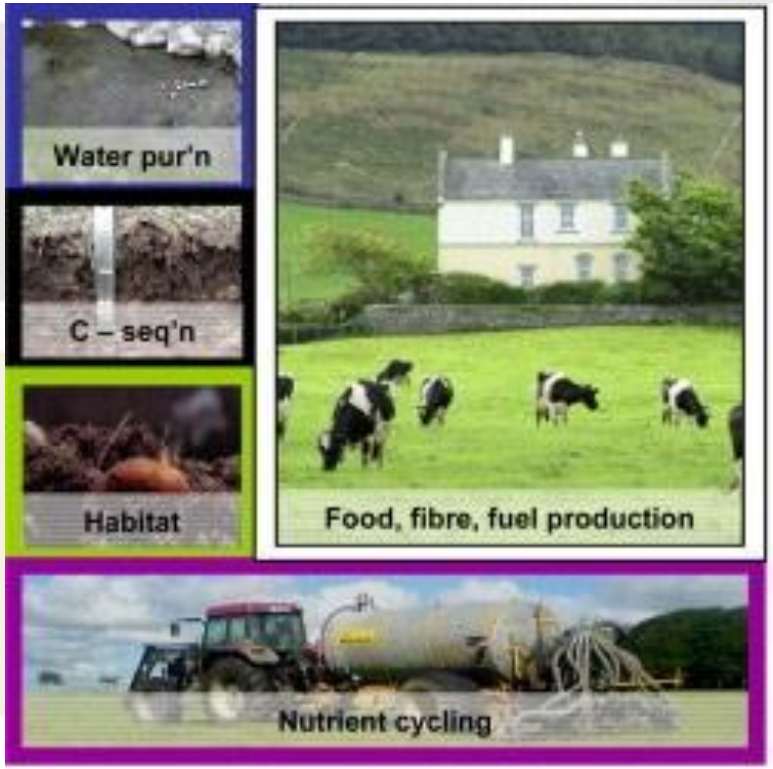
The challenge

Ecosystem services (soil functions)



Complexity of the soil

Influence of

- Parent material
- Climate
- Water
- Land use
- …

Sustainable soil management options

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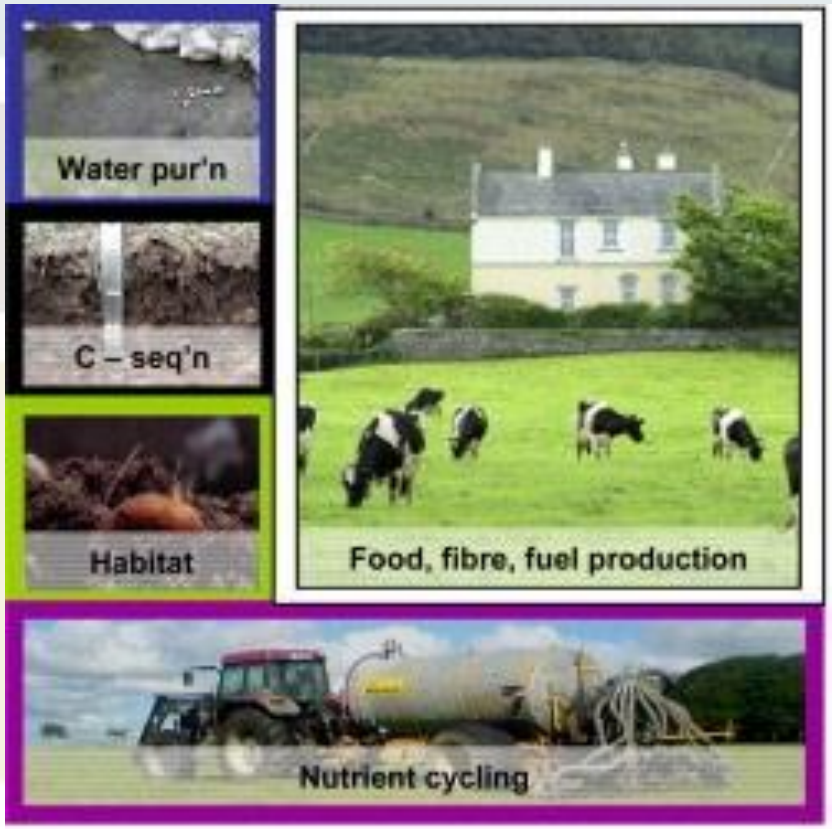
Soil functions

1. Productivity
2. Water regulation & purification
3. Nutrient cycling
4. Carbon sequestration
5. Habitat provision



Landmark, Schulte et al. 2014

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Soil quality on sandy soils

Soil quality on (light) clay soils

Long term system experiments arable farming

Soil quality on reclaimed peat soils

Soil health experiment (sandy soil)

Measures

Measures	**Circularity aspect**
Non-inversion tillage	Reduced fuel use
Standard vs. low OM input levels	Use of waste streams
Extra compost application	Use of waste streams
Growing cover crops	Reduced nutrient losses
Growing *Tagetes patula*	Less pesticide input
Anaerobic soil disinfestation	Less pesticide input
Biofumigation (*Brassicacea* cover crop)	Less pesticide input
Chitin amendments	Less pesticide/nutrient input Use of waste streams
Hair flour amendments	Less pesticide/nutrient input Use of waste streams

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Non-inversion tillage

- Soil type matters
- Yields maintained for most crops
- Improved water regulation
- Nutrient cycling affected, decreased leaching?
- None or only marginally more carbon sequestration
- Cost-benefit performance good
- Knowledge & skills important for success

Conclusion

- Applicable measure, but not for every farm

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Standard vs. low OM input levels

- Sufficient OM input gives significantly higher yields
- No effect on other soil functions
- Cost-benefit also very favourable

Conclusion:

- Manure is crucial for maintaining yield levels on a sandy soil, already applied

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Extra compost application

- Slight yield increases - not significant
- Higher nutrient surpluses
- Significantly more carbon sequestration
- High cost and low availability

Conclusion:

- Promising measure but applicability is currently limited

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Growing cover crops

- Reduced nutrient losses
- Applicability is good, limited by
  - Late harvesting
  - Plant-parasitic nematodes

Conclusion:

- Widely applied, but improvement of advise regarding cover crop choice and management is possible

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Growing *Tagetes patula*

- Effective against target nematode
- Cost-benefit favourable in arable farming when infestation is present

Conclusion:

- Applicable measure under specific conditions

Anaerobic soil disinfestation and biofumigation

- Anaerobic soil disinfestation is effective
- Biofumigation not effective or negative
- Anaerobic soil disinfestation is very expensive

Conclusion:

- Anaerobic disinfestation is effective and applicable in rotations with a high revenues on fields with a serious infestation

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Organic waste streams (chitin, hair flour)

- Chitin effective for disinfestation with high dosage
  - Risk of nutrient leaching
- Hair flour only effective as fertilizer
- Availability and costs uncertain

Conclusion:

- Chitin is promising, lower application levels can be researched

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General conclusions

Mainly positive and neutral effects from measures

- Measures without effect but entailing costs should be avoided

Promising measures are already applied, or limited by:

- High costs
- Availability of product
- Knowledge and experience

Difficult to formulate general recommendations on measures to take

- Tailor-made advice at field or farm level is needed
- Research provides insight in trade-offs and applicability of measures for policy makers and farming practice

Questions and discussion

Thank you for listening!

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Indicators for soil functions

Bodemfunctie	Indicator
Productiviteit	Productiehoeveelheid
	Productkwaliteit (gewasafhankelijk)
Waterregulatie	Bodemfysische indicatoren zoals droge bulkdichtheid , aggregaatstabiliteit, watervasthoudend vermogen en indringingsweerstand Structuurbeoordeling
Waterzuivering	N-min najaar NO_3 in bovenste grondwater
Recycling van nutriënten	N-, P-, K-overschotten
	Nutriëntenefficiëntie (afvoer vs. aanvoer)
	Aandeel N, P, K uit organische meststoffen
Koolstofvastlegging	Organische stof/koolstof in de bodem Heet water extraheerbare organische stof (HWC)
Habitat voor biodiversiteit	Voor zover beschikbaar; Potentieel mineraliseerbare stikstof (PMN), bacterie- en schimmel biomassa, aantallen en diversiteit van aaltjes, vogels, insecten en overig bodemleven

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