Christopher Brock and Guenter Leithold

The Impact of the Farming System on the Humus Household

This research work is funded by the German Federal Agency for Agriculture and Food (BLE) / Federal Program of Organic Farming

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Structure

1. Ecological and agronomical implications of humus dynamics
2. Humus dynamics in long-term field trials
3. The impact of environmental site factors and management factors
4. Assessment of farming systems
5. Conclusions

1. Ecological and agronomical implications of humus dynamics:

Ecological functions of the humus household

- filtering of input substances
- buffering of processes
- enhancment of biodiversity
- preventing erosion
- ...
- *carbon sequestration ???*

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1. Ecological and agronomical implications:

Agronomical relevance of Humus:

Conventional Agriculture (CON)	Organic Agriculture (ORG)
.....soil physical effects.....	
.....filtering.....	
.....buffering.....	
...soil biological effects.....	
..nutritive funktion (esp. N).....	

1. Ecological and agronomical implications:

Basic assumption:

- The maintenance of humus contents and the promotion of favourable humus dynamics are of great ecological as well as agronomical interest, the latter especially in organic farming!

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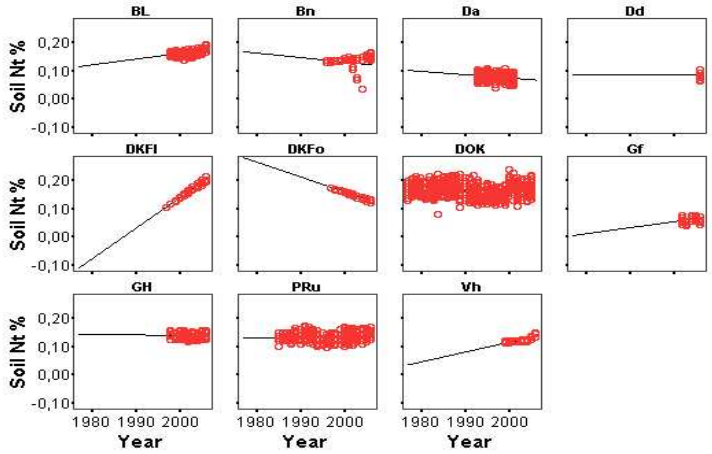
1. Ecological and agronomical implications:

Questions:

- How does the farming system influence humus dynamics?
- Can we enhance humus dynamics by adapted management?
- Can we achieve carbon sequestration by adapted management?

2. Humus dynamics in long-term field trials

Overall trend of humus dynamics in long-term trials in Germany and neighbouring countries



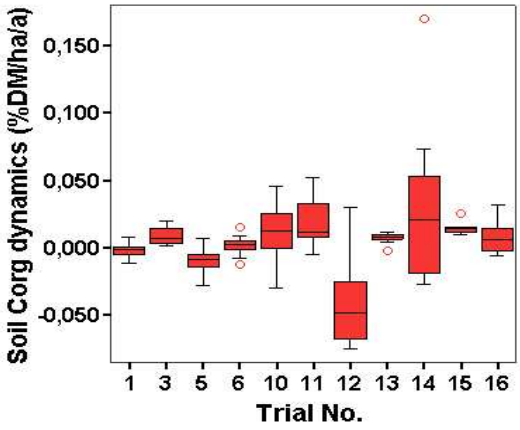
2. Humus dynamics in long-term field trials

Relevance of environmental site factors and management factors for humus dynamics

	Soil C_{org} trend (b_C)	***Soil N_t trend (b_N)***
site factors		
mean annual precipitations	-0,16*	-
mean annual temperature	-0,26**	-0,36**
fine soil content (clay + fine silt)	0,36**	-
management factors		
mean annual biomass production	0,23**	-
mean annual C input	-	0,17*
mean annual N input	-	0,16*

3. The impact of site and management factors

Environmental site conditions as decisive factor



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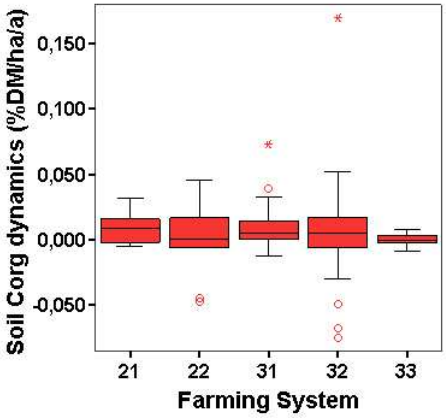

Farming system:

21: Conventional stockless with ley.

22: Conventional mixed farming with fodder legume cropping.

31: Organic stockless with ley.

32: Organic mixed farming with fodder legume cropping.

33: Biodynamic.

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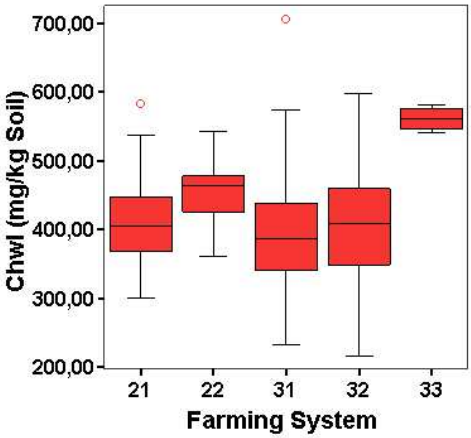
3. The impact of site and management factors

Relevance of management impact



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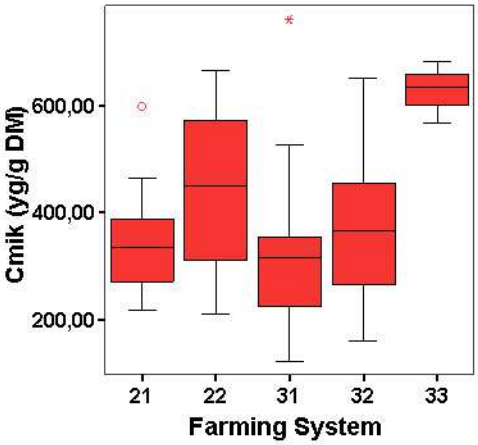

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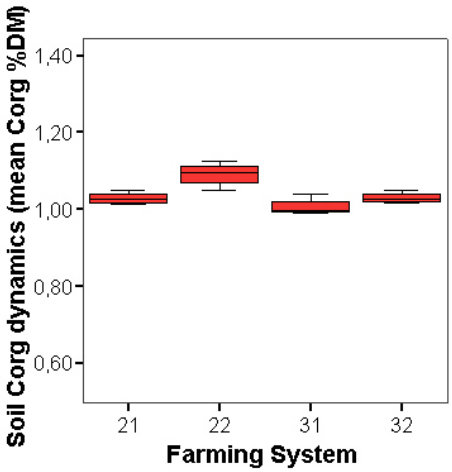
3. The impact of site and management factors

Management impact at a given site



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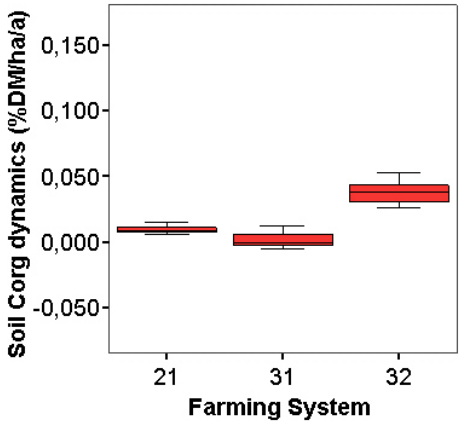

Farming system:

21: Conventional stockless without ley.

31: Organic stockless without ley.

32: Organic mixed farming with fodder legume cropping.

4. Farming system assessment:

Differentiating factors between farming systems

Organic stockless Farm

Organic Mixed Farm

Conventional Cash Crop Farm

Biodynamic Farm

Conventional Mixed Farm

Conventional Low-Input Farm

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4. Farming system assessment:

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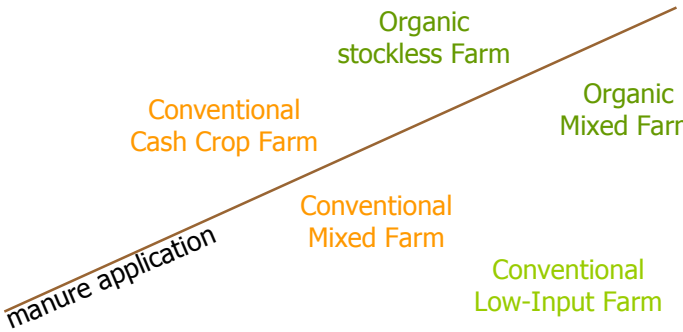

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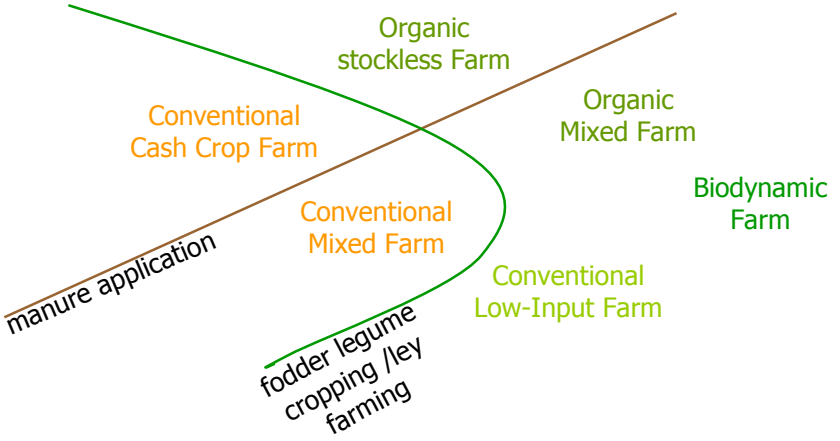

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4. Farming system assessment:

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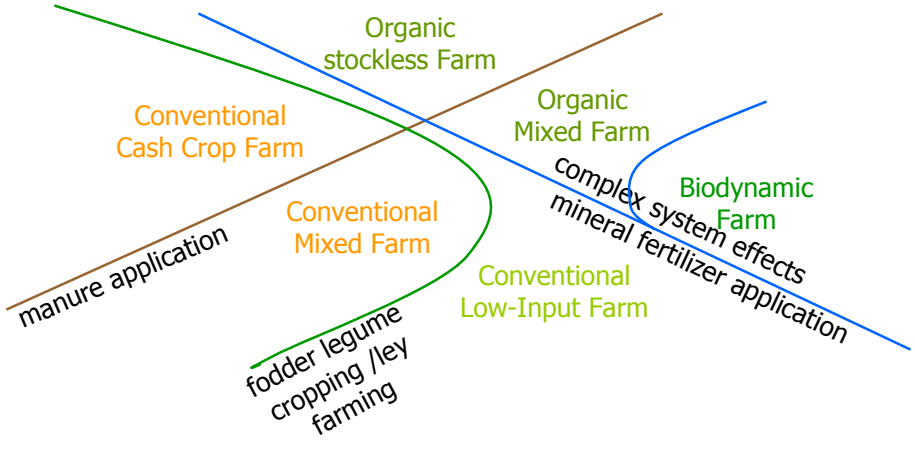

5. Conclusions:

Does organic farming have a positive impact on humus dynamics?

➢ ***Have a differentiated look !***

- The impact on humus dynamics is dependant on the set of measures forming a farming system.
- A positive impact on humus dynamics in practice often occurs with organic farming as a consequence of present organic farming systems.
- Therefore, more intensive and specialized systems (stockless cash crop farming without ley) require special attention to humus reproduction even in organic farming!

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5. Conclusions:

Can we achieve carbon sequestration by management adaptation?

➢ ***Not without fail !***

- The superposed trend of humus dynamics is determined by environmental factors and management history.
- Therefore, *sequestration* of carbon dioxide emittet elsewhere is not possible if environmental condiditons promote net decrease of humus contents at a site.
- On the other hand, carbon *retention* may be achieved by adapted management under such conditions!

5. Conclusions:

Can we enhance humus dynamics by management adaptation?

➢ ***YES !***

- Within the limits set by environmental factors, farming systems each have a specific impact on humus dynamics.
- This means that one system/set of measures can be more or less favourable than another system/set of measures.
- The ecological as well as agronomical relevance of this situation may by no means be neglected!

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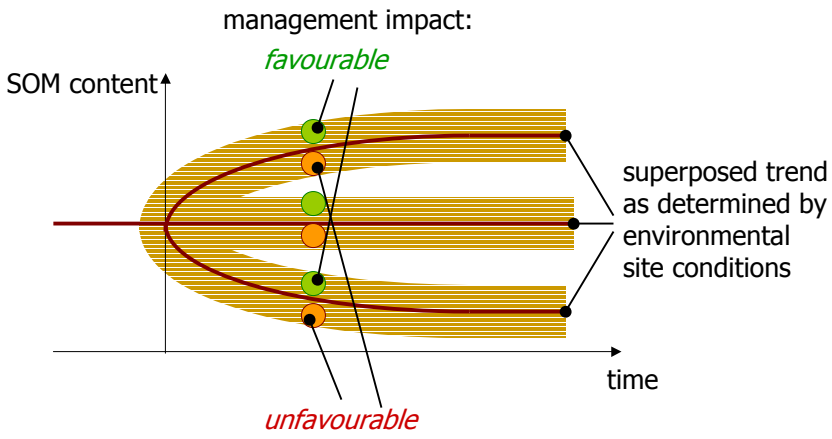
5. Conclusions:



Thank you for your attention !

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3. Humus reproduction in organic farming:

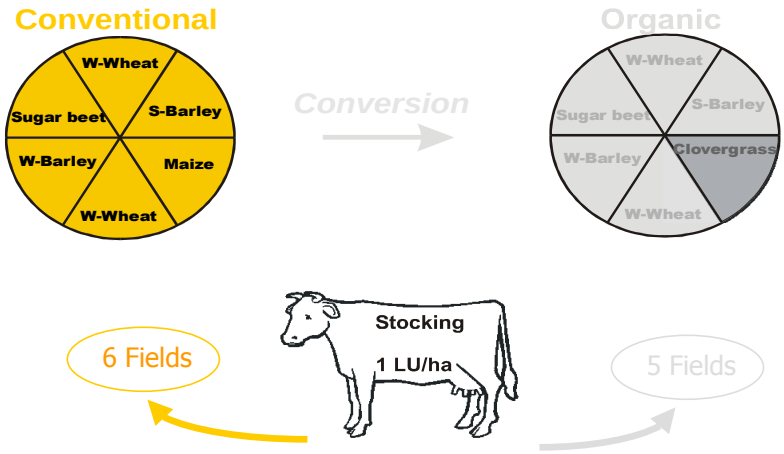
Soil organic matter content level – system effects:

Factor	*Organic*	*Conventional*
crop rotation	legume cropping	no legumes
manure application	(yes)	(no)
yields (crop residues)	lower (less?)	higher (more?)

green = positive / **red** = negative impact on SOM reproduction

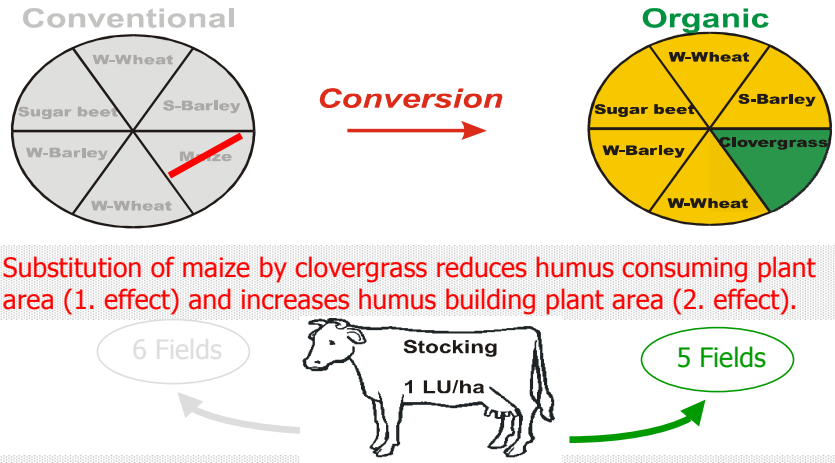
3. Humus reproduction in organic farming:

The three-fold-effect of legume cropping I:



3. Humus reproduction in organic farming:

The three-fold-effect of legume cropping II:



Substitution of maize by clovergrass reduces humus consuming plant area (1. effect) and increases humus building plant area (2. effect).

More manure per ha humus consuming plant area available (3. effect).