

Organic farming with livestock raising vs. stockless farming -

Development of soil organic matter stocks and cash crop yields

Franz Schulz, Andreas Gattinger, Christopher Brock, Günter Leithold





1. Classical ideal of an organic farm:

- mixed farming with ruminant livestock
- perennial fodder legumes
- farmyard manure application

But: 30 % of the organic farms in Germany are managed stockless

A careful assessment is necessary with regard to:

- soil fertility: soil organic matter stocks
- economical performance: cash crop yields

Map of Germany



Experimental farm Gladbacherhof

Geological allocation: North-western spur of the Taunus hill landscape

Altitude: 170 m

Mean temperature: 9.5 °C

Annual precipitation: 649 mm * a⁻¹

Soil texture: Silt with high clay content

Soil type: Orthic Luvisol

Long – term field experiment Gladbacherhof since 1998



Materials and methods: 3 different farm types

1st rotation: 1998-2003

2nd rotation: 2004-2009

3rd rotation: 2010-2015



Field no. in rotation	Year	MF (Mixed farm)	SFL (Stockless farm with mulched ley)	SFC (Stockless cash crop farm)
1	1998 2004, 2010	Alfalfa grass (harvested)	W.wheat (1998) Oats	W.wheat (1998) Oats
2	1999 2005, 2011	Alfalfa grass (harvested)	Alfalfa grass (incorporated)	Field beans
3	2000 2006, 2012	Winter wheat	Winter wheat	Winter wheat
4	2001 2007, 2013	# Potatoes	Potatoes	Potatoes
5	2002 2008, 2014	Peas+oats (2002) Winter wheat	Peas	Peas
6	2003 2009, 2015	## Winter rye	Winter rye	Winter rye

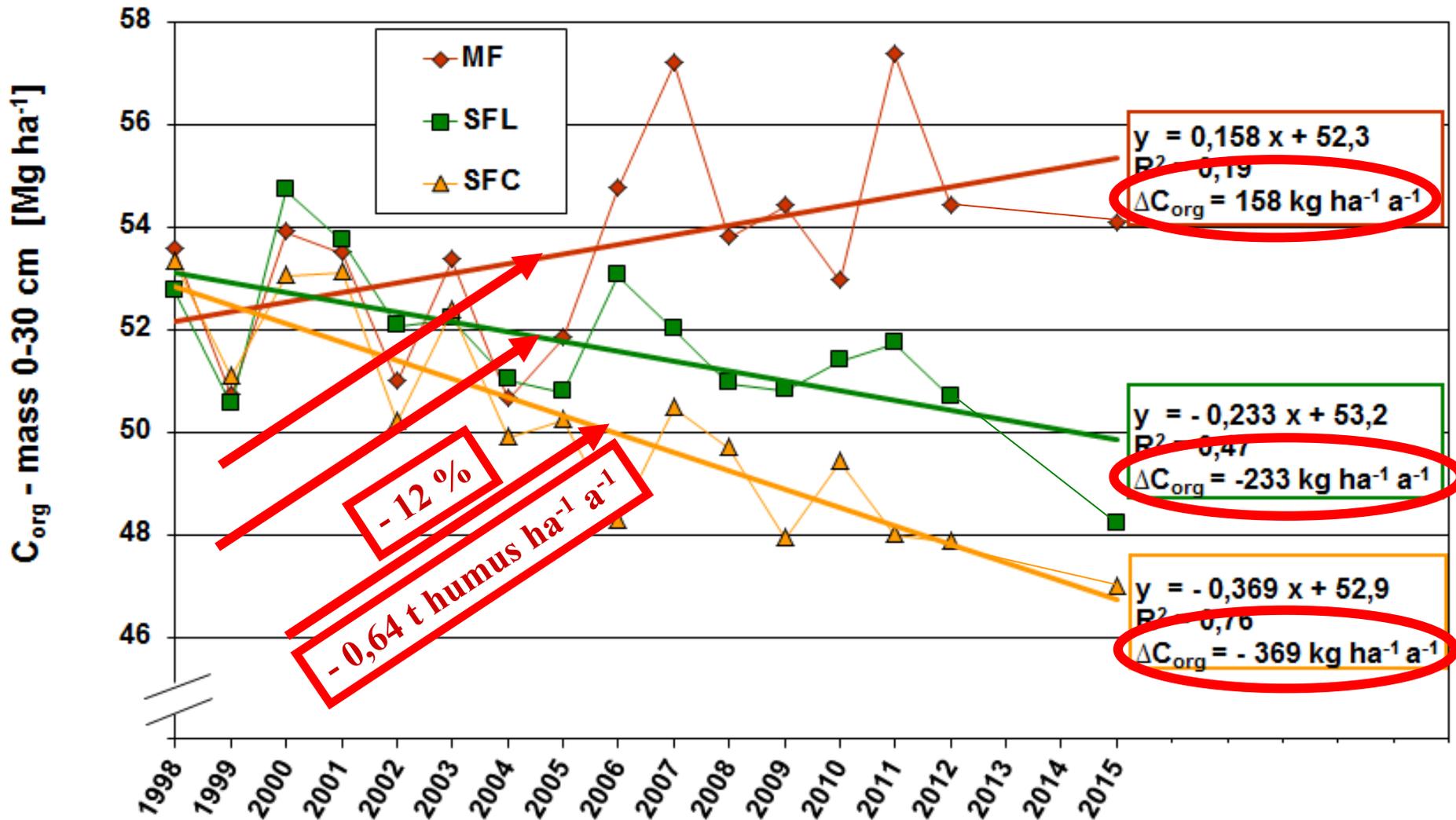
45 t ha⁻¹ farmyard manure

15 t ha⁻¹ farmyard manure

Materials and methods: arable field relation

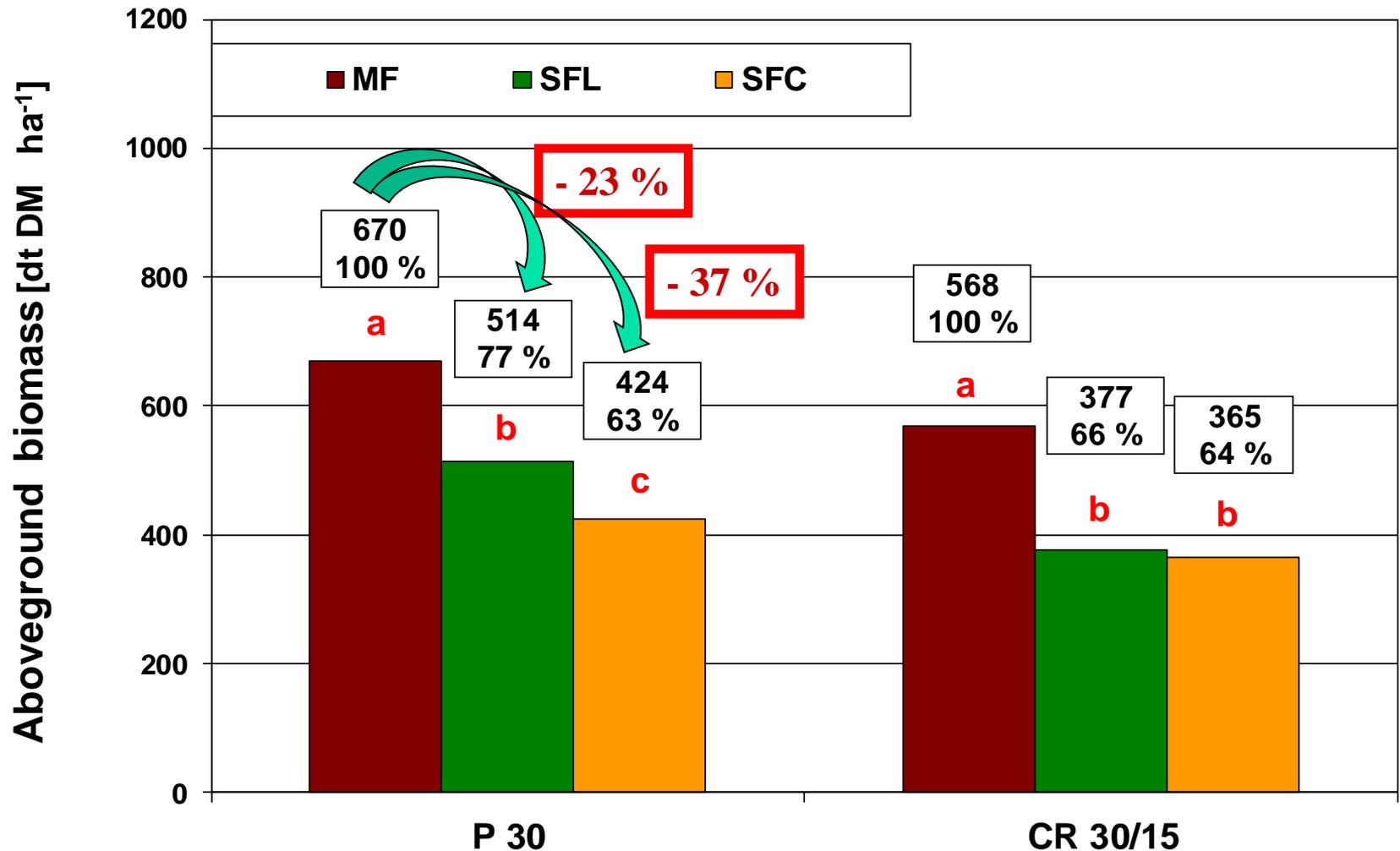
	mixed farming	stockless farming	
	MF	with mulched ley SFL	cash crops only SFC
arable field relation (%)			
- cereals	50,0	50,0	50,0
- root crops	16,7	16,7	16,7
- fodder legumes	33,3		
- grain legumes		16,7	33,3
- fallow land		16,7	
undersown crops (%)	33,3		16,7
stubble seed (%)	16,7	33,3	50,0
manuring	annual mean 80 dt/ha farm yard manure	<ul style="list-style-type: none"> • growth of fallow land is mulched • straw of cereals is manured on 50 % of the AF-area • straw of peas is manured on 16,7 % of the AF-area 	<ul style="list-style-type: none"> • straw of cereals is manured on 50 % of the AF-area • straw of peas and beans is manured on 33 % of the AF-area

Results I: Soil organic matter stocks 1998 – 2015



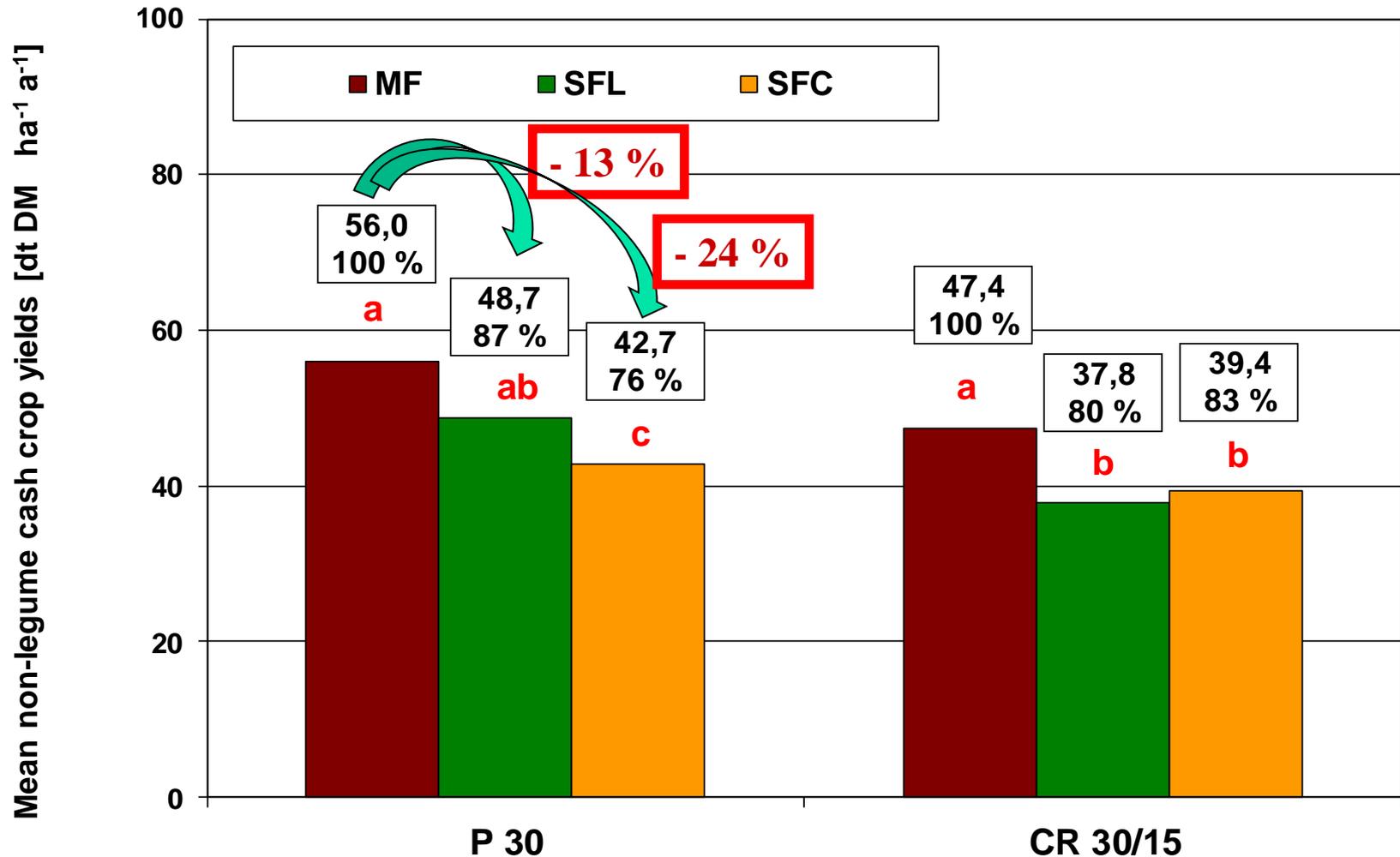
Development of soil organic carbon masses in OAFEG topsoil dependent on farm type

Results II: Aboveground biomass 2010 – 2015



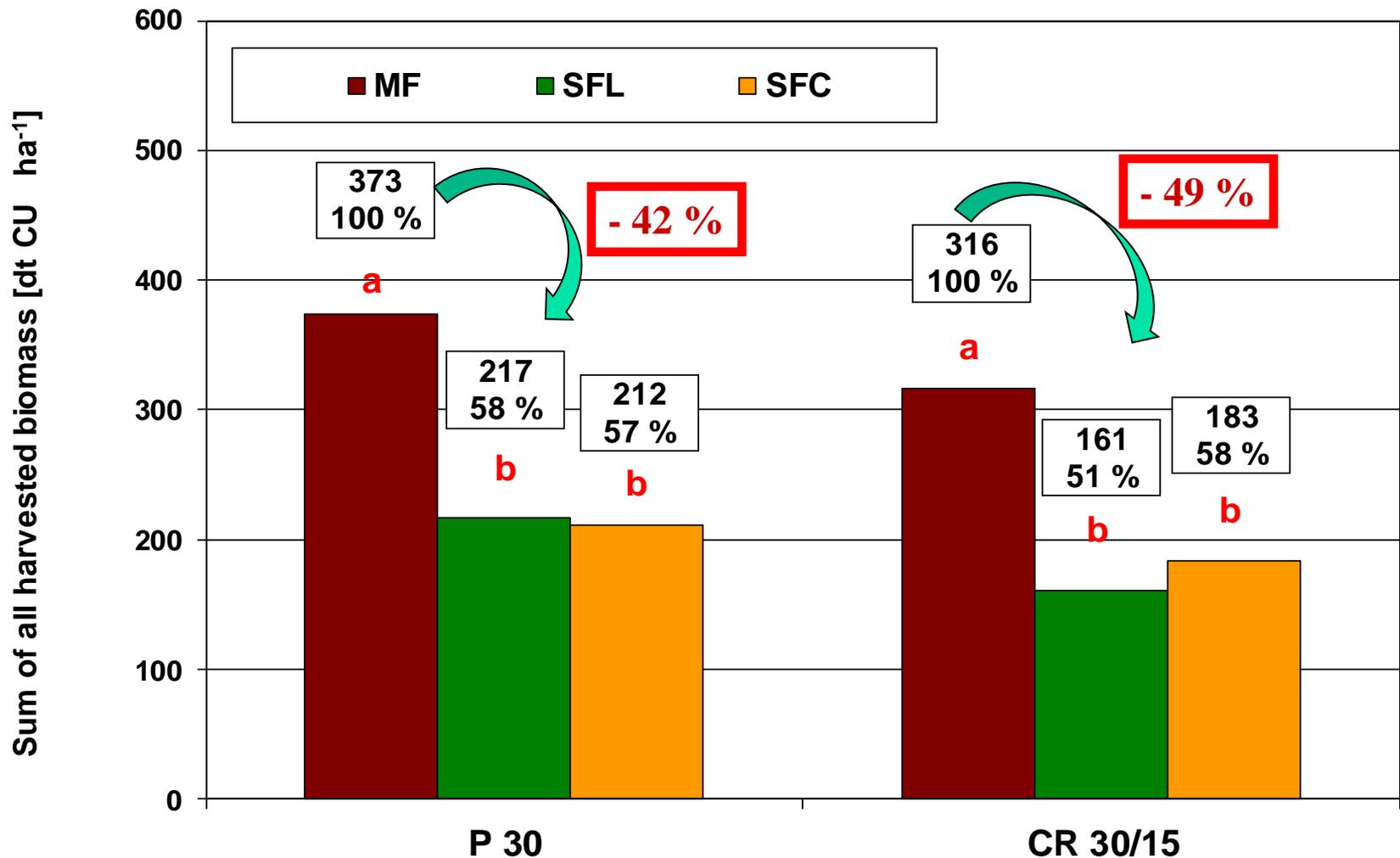
Aboveground biomass in OAFEG dependent on farm type

Results II: Mean non-legume cash crop yields 2010 – 2015



Mean non-legume cash crop yields in OAFEG dependent on farm type

Results II: Sum of all harvested biomass 2010 – 2015



Sum of all harvested biomass in OAFEG dependent on farm type



- **Soil fertility:** with ruminant livestock: increase of SOM
stockless farming: decrease of SOM
- **Yields:** stockless mulched ley: lower yields
stockless cash crops only: considerably lower yields

Approaches unless stockless farming cannot be avoided:

- cooperation with farms with ruminant livestock (fodder \leftrightarrow manure)
- inclusion of a mulched rotational ley in the crop rotation
- biogas plant: fermentation of vegetable residues and coproducts
- restriction of the cultivation strongly humus draining crops (potatoes, maize, field vegetables)
- fodder- and grain legumes as much as possible in the crop rotation



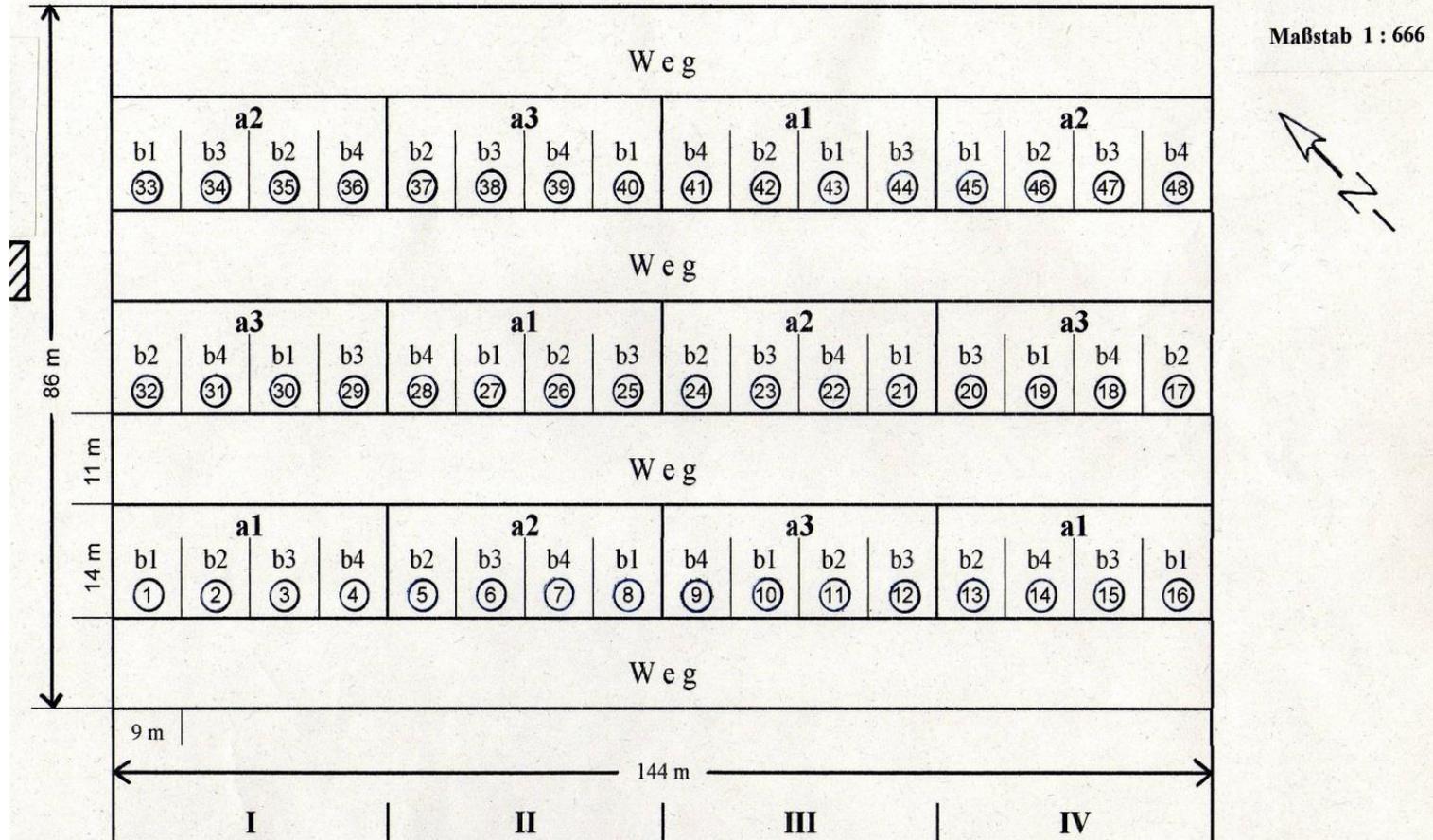


Thank you for your attention

Parzellenplan

Ackerbauversuch Gladbacher Hof

Version: 26.01.99



- a1 - a3 = Fruchtfolgen
- b1 - b4 = Bodenbearbeitungssysteme
- I, II, III, IV = Wiederholungen (Blöcke)
- ① - ④⑧ = Parzellen-Nummern

Luzerne-Klee-gras-Mischung

1. Medicago sativa	12,0 kg*ha⁻¹
2. Trifolium pratense	4,0 kg*ha⁻¹
3. Festuca pratensis	3,5 kg*ha⁻¹
4. Phleum pratense	4,5 kg*ha⁻¹
5. Lolium perenne	4,0 kg*ha⁻¹