

# Relationship between grassland management and bovine milk quality



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# Introduction

- ▶ Dairy production in middle Norway based on short-term or long-term **grassland systems**
- ▶ Organic and conventional **production systems**
- ▶ How does grassland system and production system affect milk quality?



# Introduction

- ▶ High concentrate level decreases C16:0 FA and equol in milk compared to low concentrate level

Shingfield *et al.*, 2005

Steinshamn *et al.*, 2008

- ▶ Red clover increases milk fat concentrations of C18:3n-3 FA and PUFA, and equol in milk compared to white clover

Dewhurst *et al.*, 2003

Steinshamn *et al.*, 2008





# Objective

Investigate the effect of  
**grassland system**  
*short-term or long-term*  
and **production system**  
*organic or conventional*  
on bovine milk quality in middle  
Norway.



# Material and methods

## Field study in middle Norway 2007-2008

32 dairy farms

- ▶ 9 short-term grassland – organic (SO)
- ▶ 9 short-term grassland – conventional (SC)
- ▶ 7 long-term grassland – organic (LO)
- ▶ 7 long-term grassland – conventional (LC)



# Material and methods

## Data collection

- ▶ Tanker milk samples every second month
- ▶ Feed samples every second month
- ▶ Norwegian Dairy Herd Recording System
- ▶ Interviews
- ▶ Botanical analysis before 1<sup>st</sup> cut 2007
- ▶ **Results from 2007**



## Results and discussion

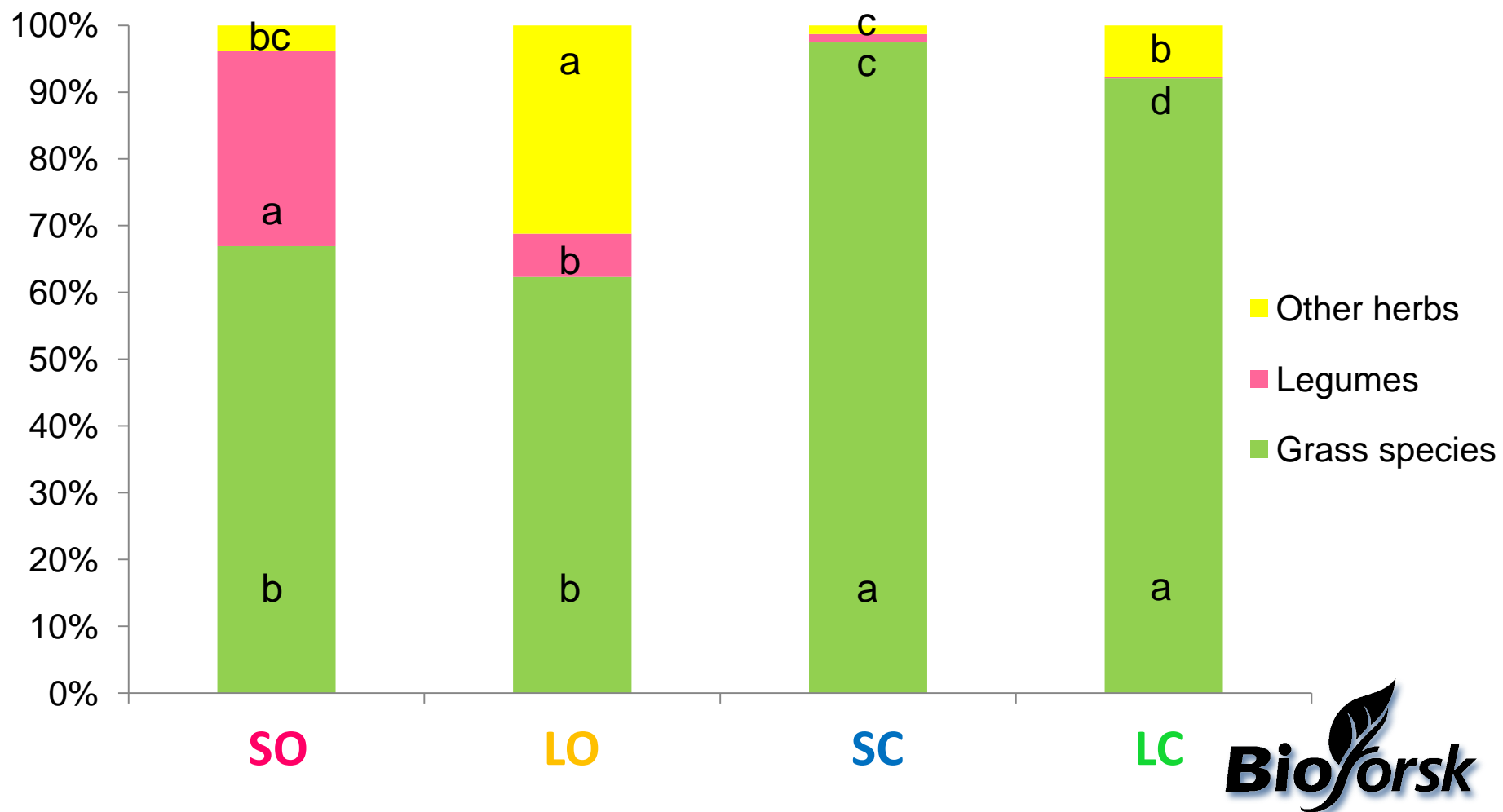
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<b>Farm characteristics</b>	<b>SO</b>	<b>LO</b>	<b>SC</b>	<b>LC</b>
Grassland age, years	2.9	11.4	2.8	9.9
Non-forage crops of total area	14%	1%	19%	0%

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# Results and discussion

Botanical composition before 1<sup>st</sup> cut 2007 (dry weight rank method)



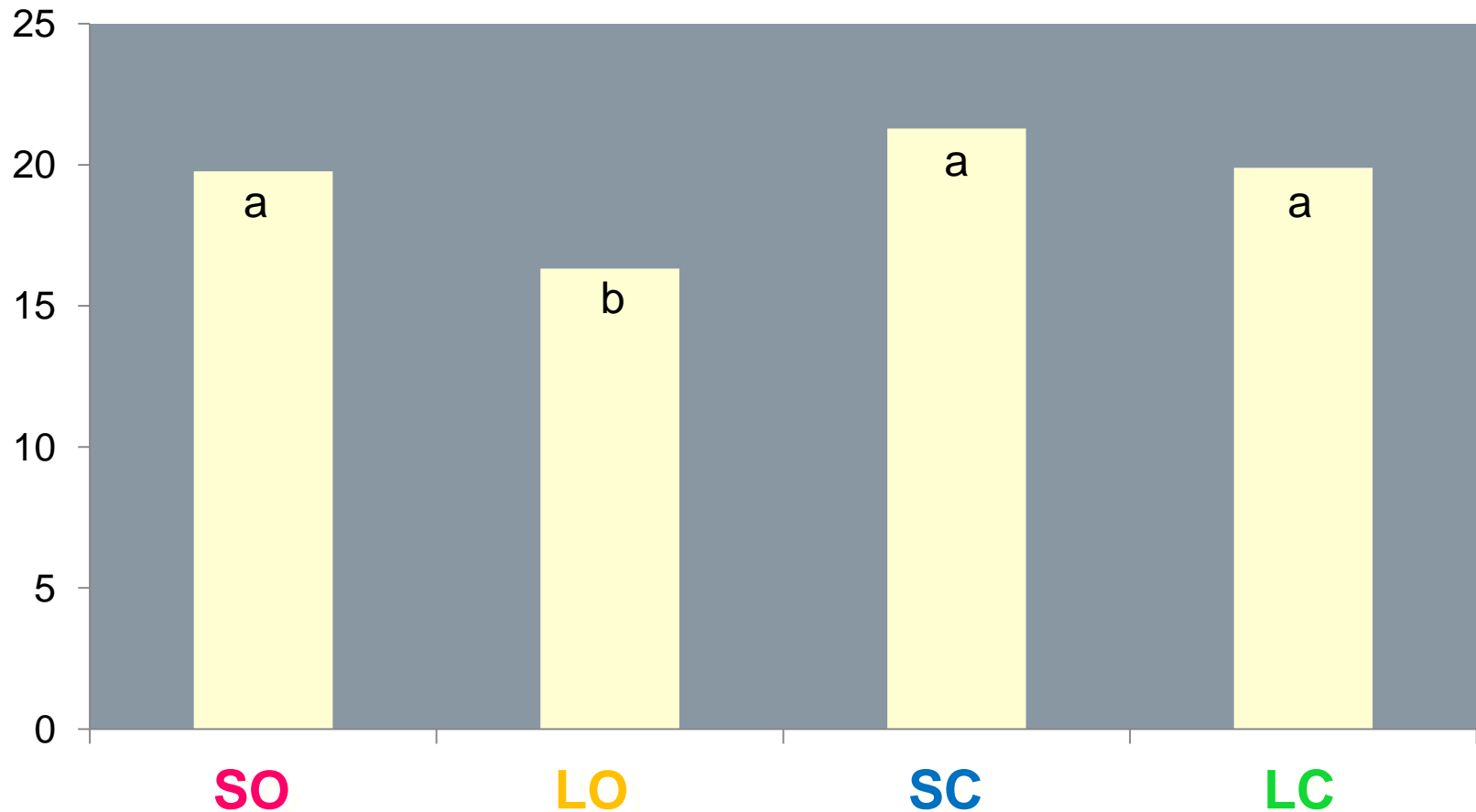


## Results and discussion

<b>Feeding</b>	<b>SO</b>	<b>LO</b>	<b>SC</b>	<b>LC</b>
Concentrates, NEL MJ/d	38.0 <sup>bc</sup>	30.3 <sup>c</sup>	45.4 <sup>ab</sup>	49.8 <sup>a</sup>
Forage prop. of total DM intake	0.60 <sup>ab</sup>	0.64 <sup>a</sup>	0.55 <sup>ab</sup>	0.46 <sup>b</sup>
Forage CP, g/kg DM	135 <sup>b</sup>	142 <sup>b</sup>	169 <sup>a</sup>	167 <sup>a</sup>
Forage NDF, g/kg DM	534 <sup>b</sup>	558 <sup>ab</sup>	570 <sup>a</sup>	576 <sup>a</sup>

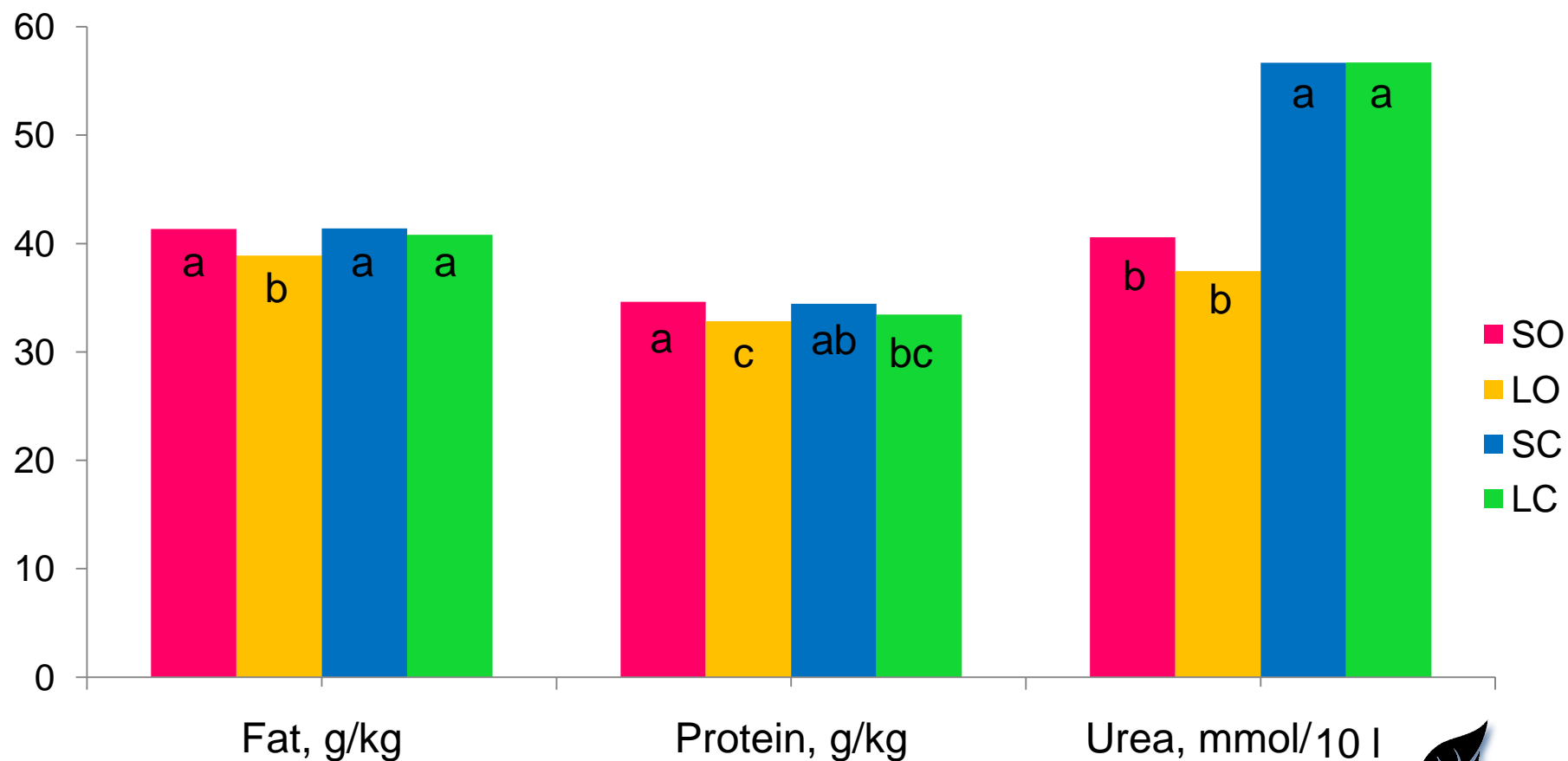
# Results and discussion

Milk yield, kg/day



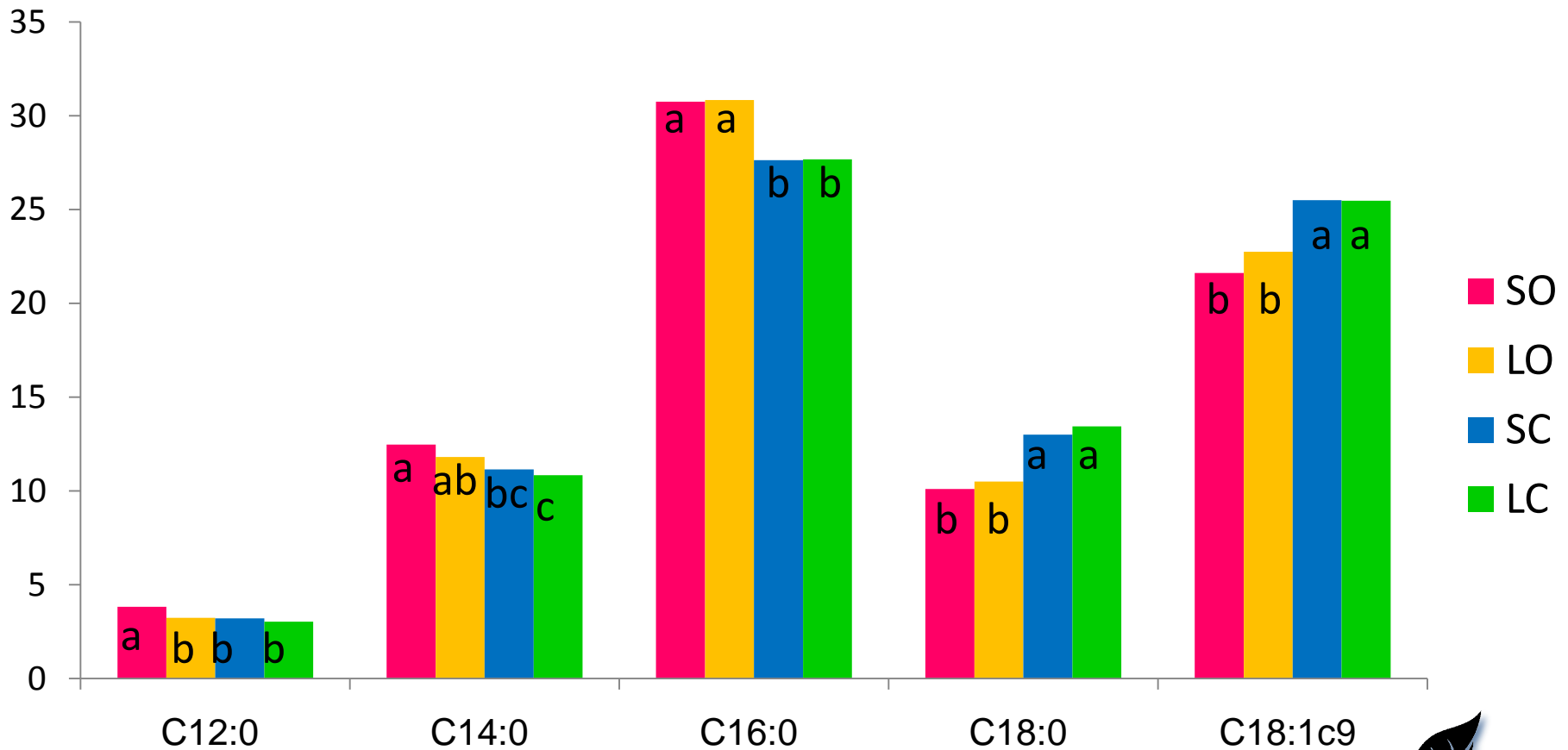
# Results and discussion

## Milk chemical composition



# Results and discussion

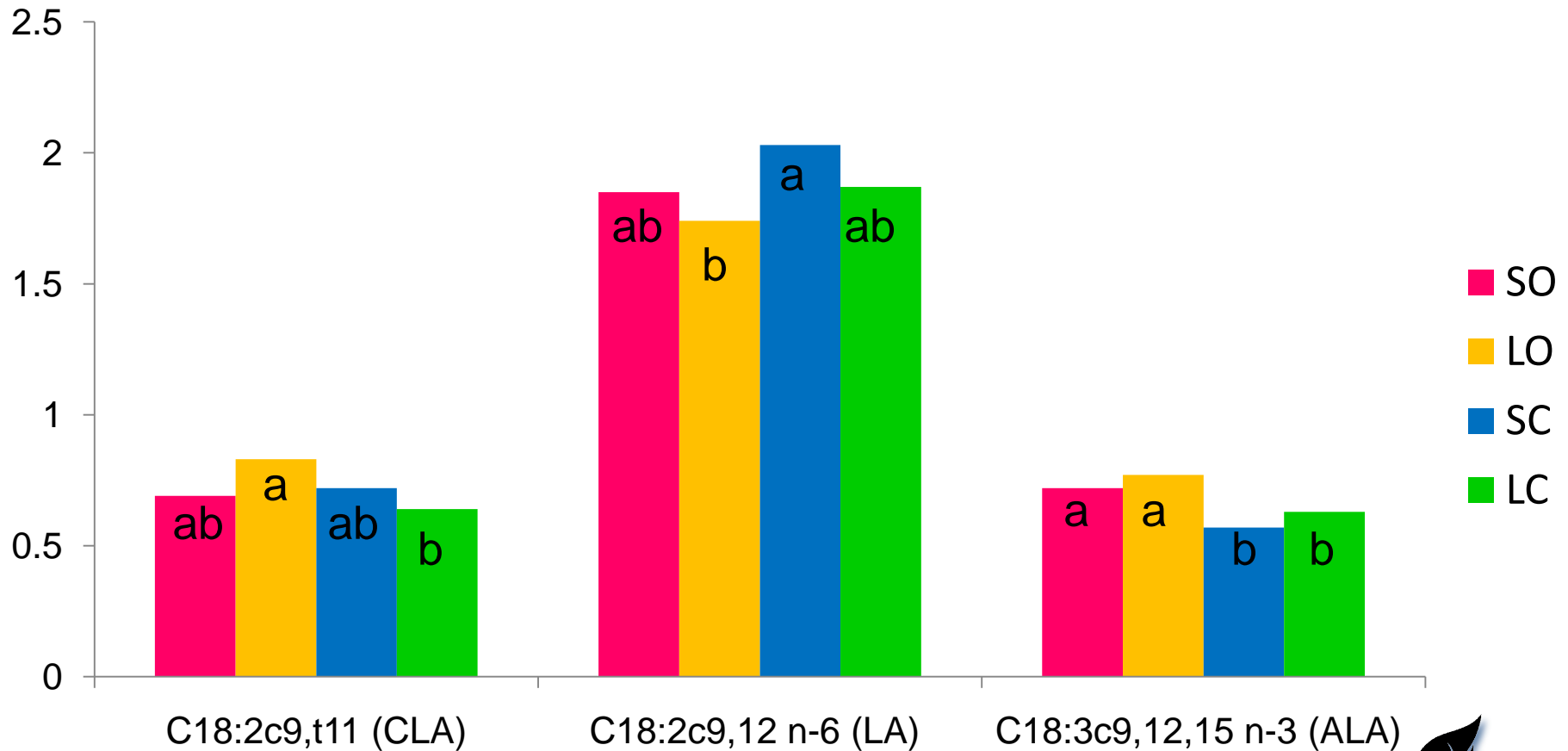
## Milk fatty acid composition, g/100 g FAME





# Results and discussion

## Milk fatty acid composition, g/100 g FAME



## Results and discussion

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<b>Milk</b>	<b>SO</b>	<b>LO</b>	<b>SC</b>	<b>LC</b>
$\beta$ -carotene, mg/l	0.18 <sup>b</sup>	0.19 <sup>ab</sup>	0.21 <sup>a</sup>	0.21 <sup>ab</sup>
Selenium, $\mu$ g/100 ml	2.18 <sup>a</sup>	1.87 <sup>b</sup>	1.83 <sup>b</sup>	1.66 <sup>b</sup>

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## Results and discussion

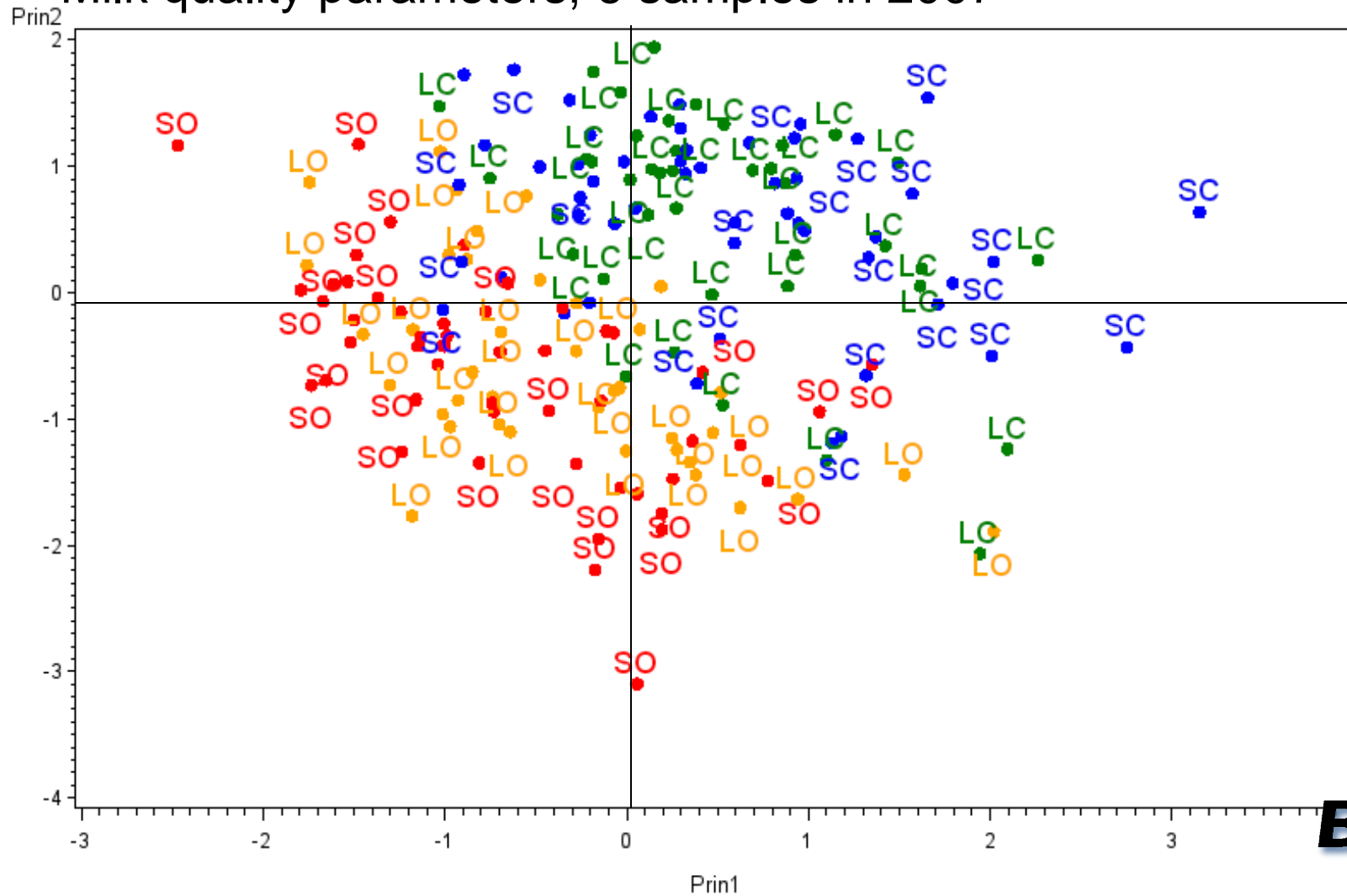
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Phytoestrogens, µg/l	SO	LO	SC	LC
Equol (isoflavonoid)	284.4 <sup>a</sup>	86.8 <sup>b</sup>	57.3 <sup>b</sup>	50.7 <sup>b</sup>
Enterolactone (lignan)	135.0 <sup>a</sup>	98.8 <sup>ab</sup>	79.5 <sup>b</sup>	76.8 <sup>b</sup>

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# Principal Component Analysis - Score plot

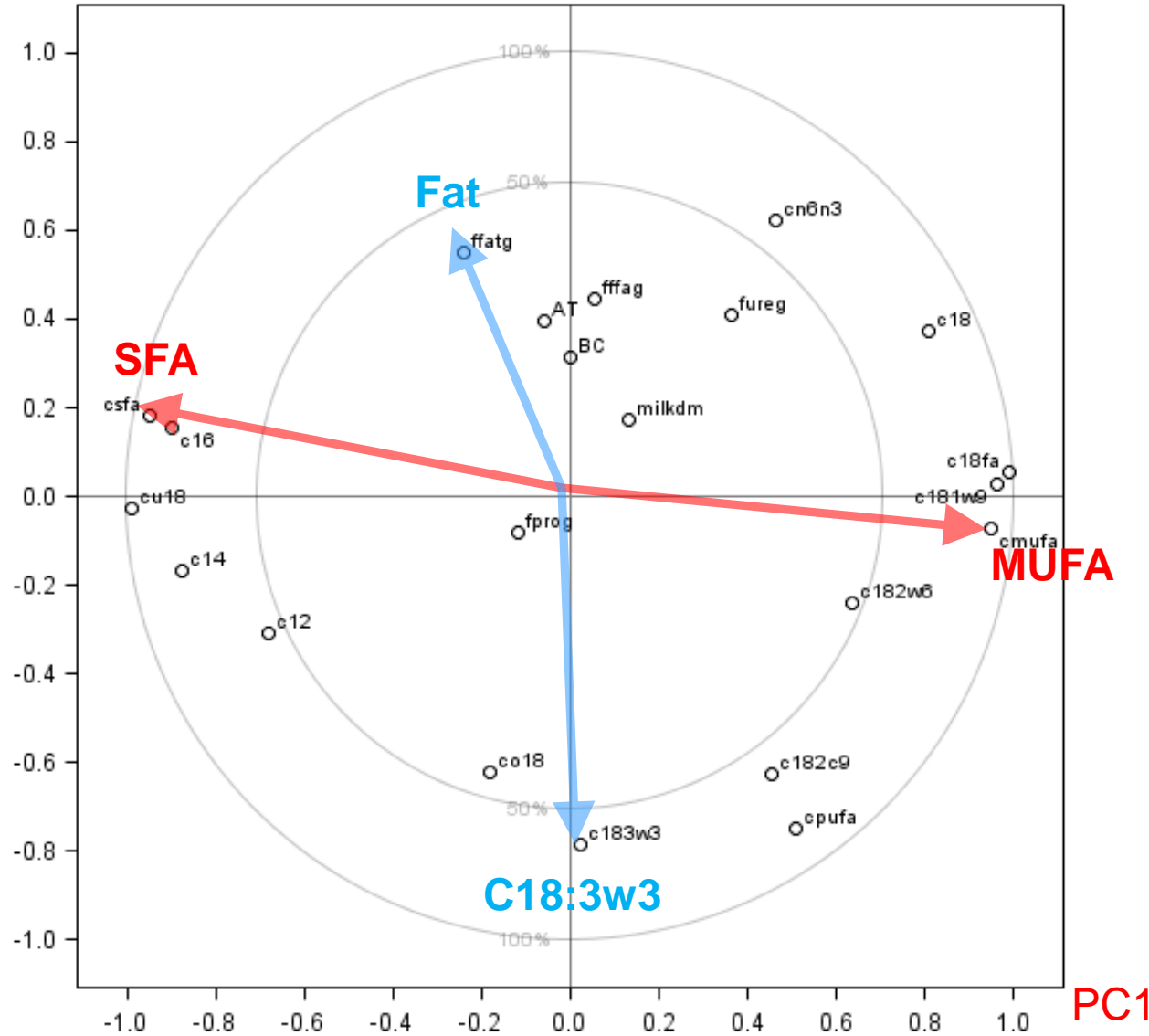
Milk quality parameters, 6 samples in 2007





# Principal Component Analysis - Pattern plot

PC2



PC1: 39.7%  
"SFA - MUFA"

PC2: 16.8%  
"Fat conc. - C18:3w3"

# Conclusions

Milk quality was more affected by production system than grassland system.

Presumed factors were

- ▶ level of concentrates,
- ▶ concentrate content of lipids and
- ▶ forage botanical composition.



# Thank you!

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