Effect of forage legumes on milk quality - review

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Introduction

- Grassland legumes essential role in organic farming
  - N fixation capacity and productivity
  - Feeding value
- Renewed interest for grassland legumes in general
  - New research results

Objective

- Summarize the effect of grassland legumes in silage based diets on:
  - Feed intake
  - Milk production
  - **Milk composition**

Material methods

- Data gathered from literature
- Dairy cows on silage based diets
- Six different dataset created
  - Grass (G) vs. Legume (L), n=14
  - G vs. Red clover (RC), n=11
  - G vs. White clover (WC), n=7
  - RC vs. WC, n=6
  - Lucerne (M) vs. RC, n=5
  - RC proportion 0.5 vs. 1.0, n=5

Studies included and datasets created

Source (Experiment)	Legume species	Datasets					
		G vs L	G vs RC	G vs WC	RC vs WC	RC vs M	RC prop.
Castle et al. 1983 (1)	WC	X		X			
Castle et al. 1983 (2)	WC	X		X			
Thomas et al. 1985	RC	X	X				
Randby 1992	RC	X	X				
Hoffman et al. 1997 (1)	RC, M					X	
Hoffman et al. 1997 (2)	RC, M					X	
Hoffman et al 1998	M	X					
Broderick et al. 2000	RC, M					X	
Broderick et al. 2001	RC, M					X	
Bertilsson & Murphy 2003 (1)	RC, WC	X	X	X	X		X
Bertilsson & Murphy 2003 (2)	RC,WC	X	X	X	X		X
Dewhurst et al. 2003 (1)	RC, WC, M	X	X	X	X	X	X
Dewhurst et al. 2003 (2)	RC, WC	X	X	X	X		X
Al-Mabruk et al. 2004	RC	X	X				
Vanhatalo et al. 2007, 2009	RC	X	X				
Van Dorland et al. 2008	RC, WC	X	X		X		
Vanhatalo et al. 2008	RC	X	X				
Steinshamn & Thuen 2008	RC, WC				X		
Moorby et al. 2009	RC	X	X				X
Total number of comparisons		**14**	**11**	**7**	**6**	**5**	**5**

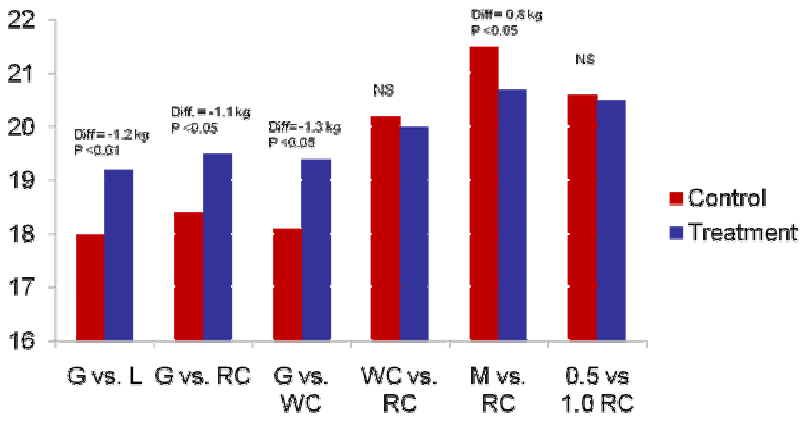
Material methods

Statistic

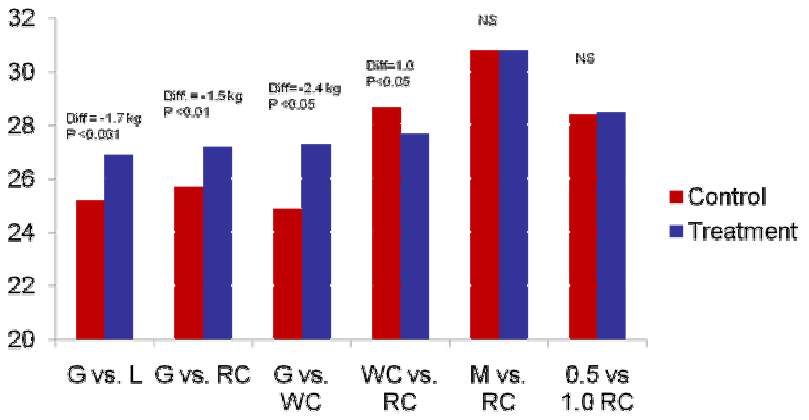
Simple t-test with experiment as replicate

Results

Dry matter intake (kg/day)



Milk yield (kg/day)



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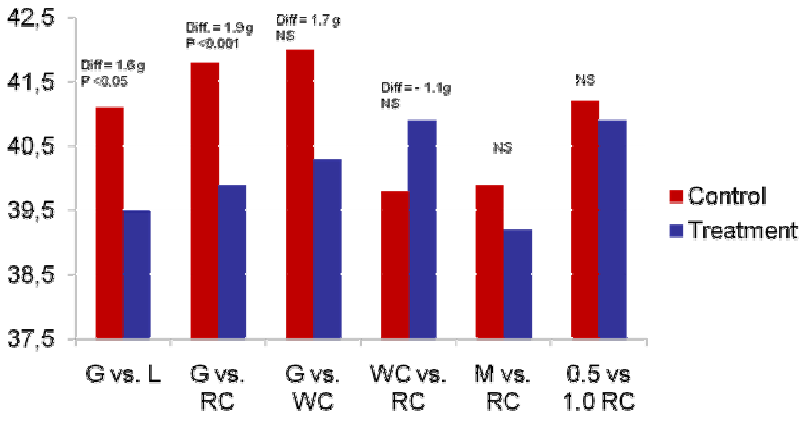
Milk fat content (g/kg)



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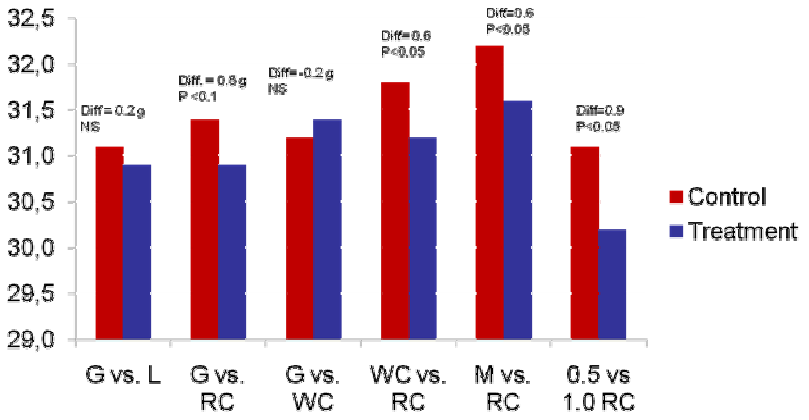
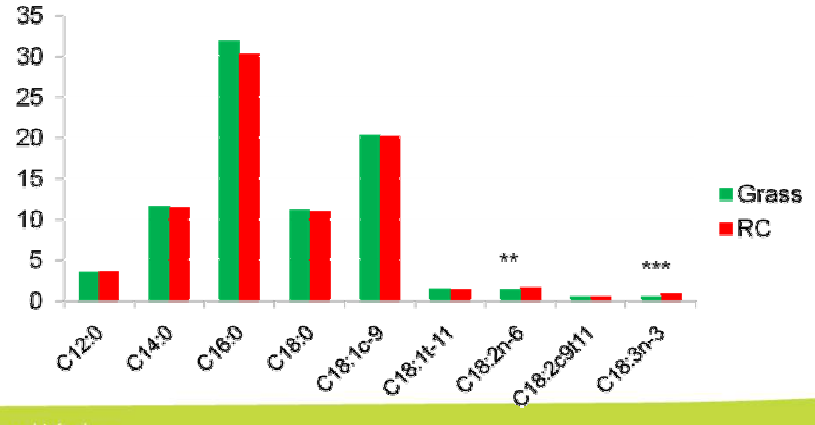
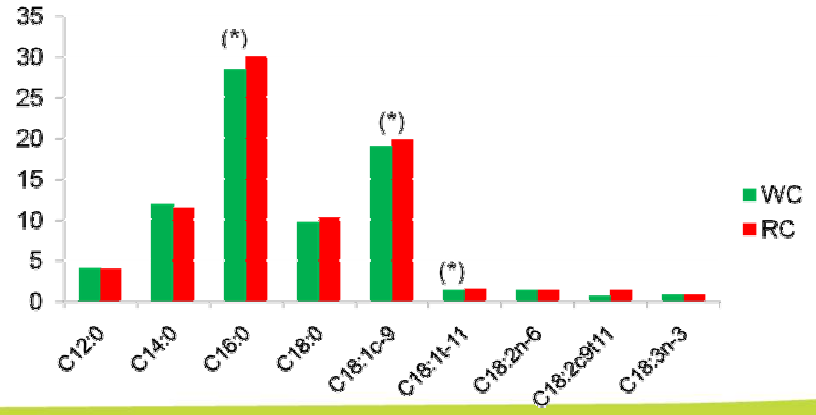
Milk protein content (g/kg)



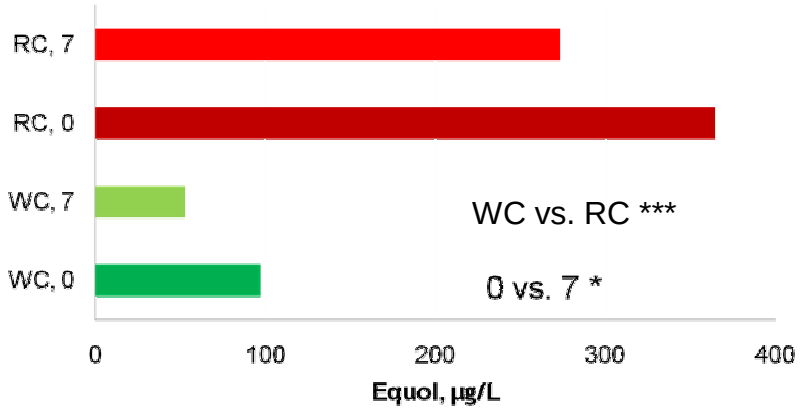
Milk fatty acid composition (g/100g FAME) n=8



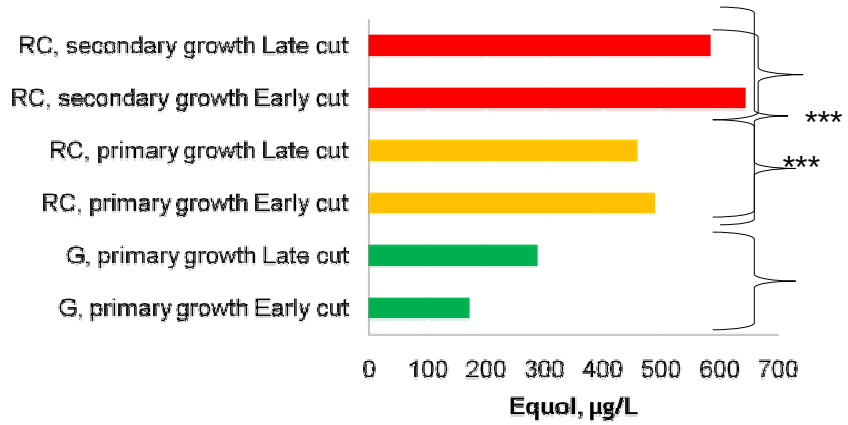
Milk fatty acid composition (g/100g FAME) n=4



Milk equol content (Steinshamn et al. 2008



Milk equol content (Mustonen et al. 2009



Summary grass vs legumes

- DMI
  - Legumes + 1.2 kg
  - Red clover + 1.1 kg
  - White clover + 1.3 kg
- Milk yield
  - Legumes + 1.6 kg
  - Red clover + 1.5 kg
  - White clover + 2.4 kg

Summary grass vs legumes

- Milk fat content
  - Legumes – 1.5 g/kg
  - Red clover – 1.9 g/kg
- Milk protein content
  - Red clover -0.5 g/kg
- Milk fatty acid composition
  - Red clover + C18:2n-6 and C18:3n-3

Legume species

- DMI
  - Lucerne vs. red clover +0.8 kg
- Milk yield
  - White clover vs. red clover + 1.0 kg
- Milk protein content
  - White clover vs. red clover + 0.6 g/kg
  - Lucerne vs. red clover + 0.6 g/kg

Legume species

- Milk fatty acid proportion
  - Red clover vs grass + C18:2n-6 and C18:3 n-3
- Milk equol content
  - Red clover vs. grass or white clover +

Conclusions

- Legumes increase DMI and milk yield relative to grass
- White clover is superior to red clover in milk yield
- Red clover is superior to lucerne in milk yield

Conclusions

- Red clover yields lower milk fat content than grass
- Red clover yields lower milk protein content than white clover and lucerne
- Increasing red clover proportion reduces milk protein content
- Red clover yields higher milk proportion of C18:2n-6 and C18:3n-3 than grass
- Red clover yields milk with high content of equol

Concluding remark

- Negative effect of red clover on milk fat and protein content warrants further research