

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 |

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Material methods

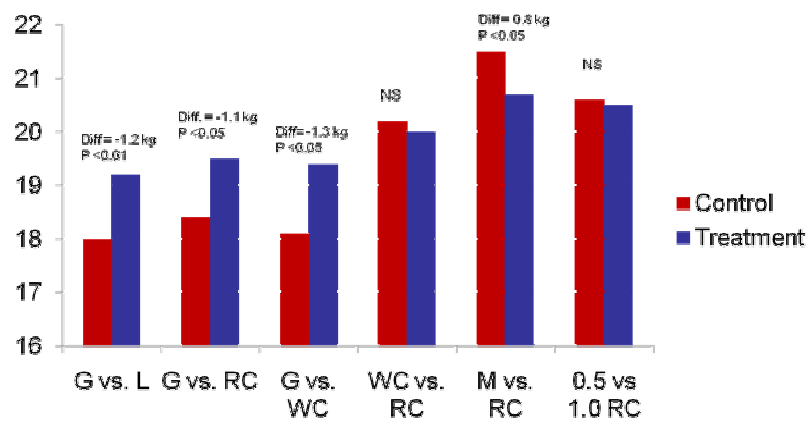
Statistic

Simple t-test with experiment as replicate

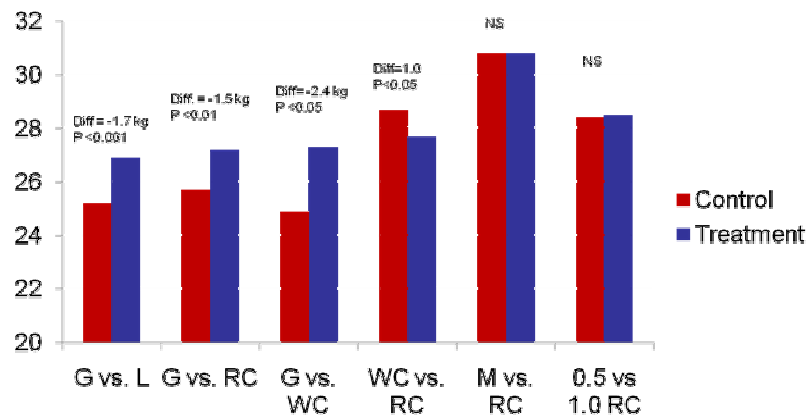
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Results

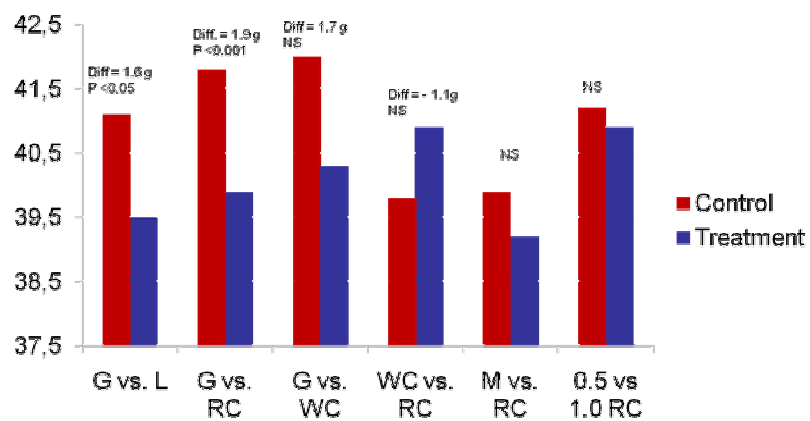
Dry matter intake (kg/day)



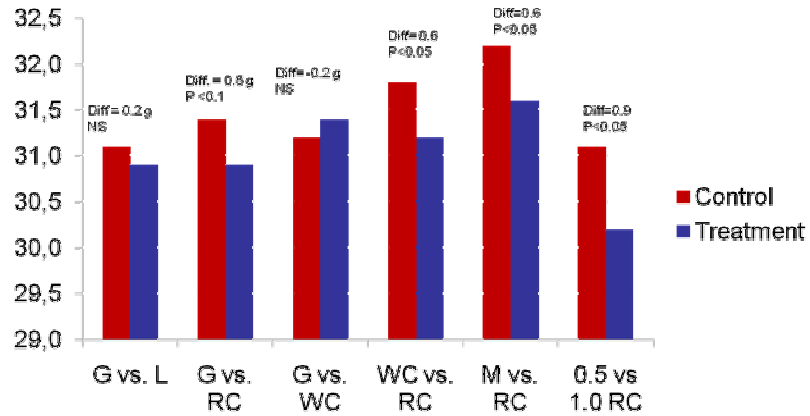
Milk yield (kg/day)



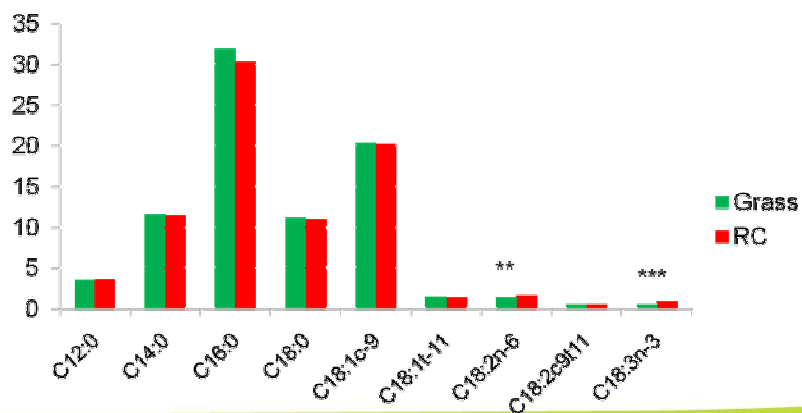
Milk fat content (g/kg)



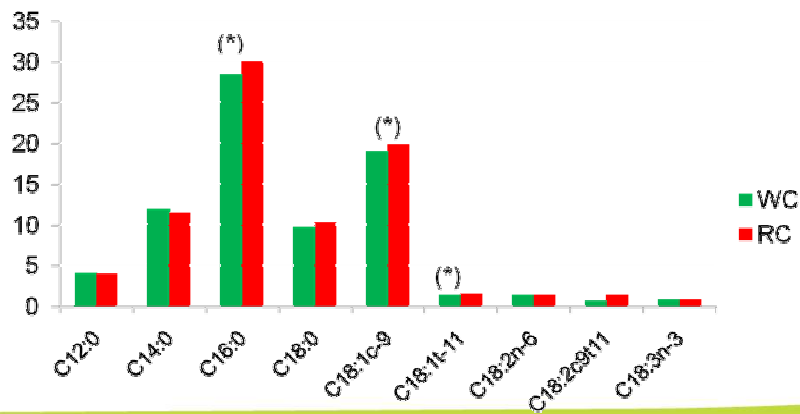
Milk protein content (g/kg)



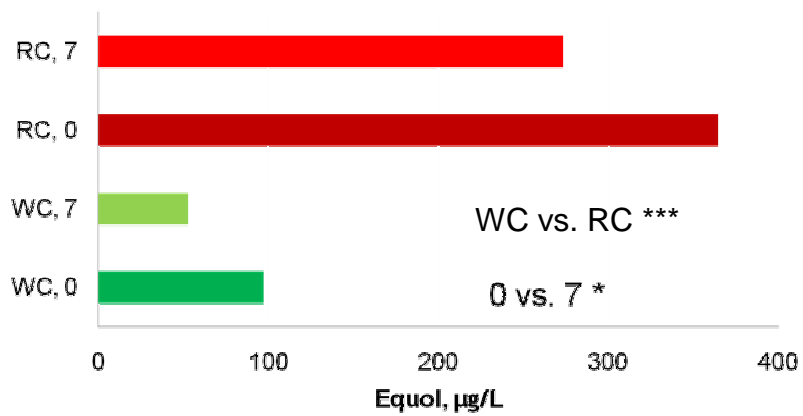
Milk fatty acid composition (g/100g FAME) n=8



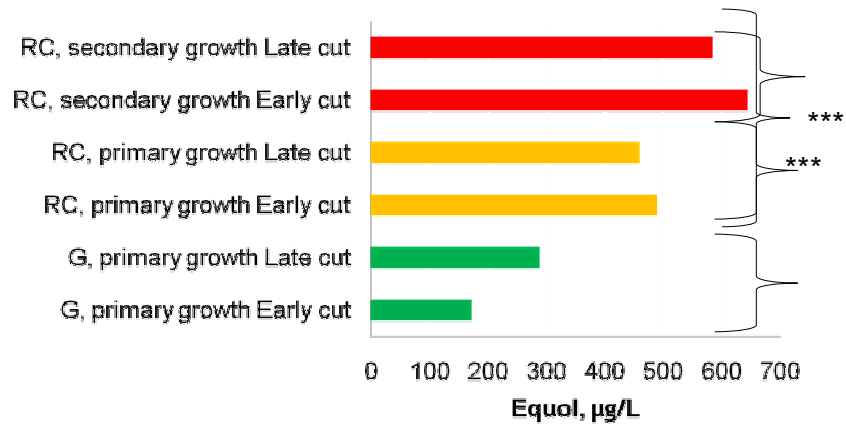
Milk fatty acid composition (g/100g FAME) n=4



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