Wallonie recherche
CRA-W

Centre wallon de Recherches agronomiques

# *Performances and greenhouse gas emissions of alternative beef production schemes under organic farming*

M. Mathot
A. Mertens
D. Stilmant
V. Decruyenaere

# Introduction

Fattening males in the suckler cow farms:

- environment: cattle movement across region or countries, valorisation of grassland resources (45 % agricultural land)
- social: local production,
- economic: diversification, valuable products

but : few co-products available and targetting autonomy.

| | Castration | Grass in diet | Daily live weight gain |
|---|---|---|---|
| Bulls | no | - | + |
| Steers | yes | + | - |

(INRA, 2018)

Social acceptation
Local resources

# Aim

Comparision of bull and steer fattening scheme under organic farming using local resources and breed (DPBB)


Dual purpose Belgian Blue Breed males (DPBB)

- Cattle performances
- Greenhouse gas emissions (enteric, manure and feed production[1])
- (Economics)



[1]Agribalyse

# Methodology

Changing phase criteria: Season → Weight → Weight, fattening state and age

| | | Pasture | Growing | Finishing | Slaughter |
|---|---|---|---|---|---|
| Dual purpose Belgian Blue (DPBB) | Steer (n=2) | Grass | Diet 1 | Diet 3 | |
| | Bull (n=2) | Grass | Diet 2 | Diet 4 | |
| Limousin (LIM) | Steer (n=2) | Grass | Diet 1 | Diet 3 | |
| | Bull (n=2) | Grass | Diet 2 | Diet 4 | |

Same diet for the two breeds

- Scheme repeated three times
- Limousin to compare DPBB breed performances to a reference

# Barn

- Rearing in barn
- Adapation to greenfeed
- All young cattles of a given repetition alltogether

Pasture

# Pasture

- Animals grazing alltogether
- No information about the intake level

Barn for fattnening

## Barn

Individual

By 2 cattle

- Growing and finishing
- Grouped by treatment due to cattle behaviour (steers vs bulls)
- Daily intake were quantified
- Manure at barn and store (n=2), (Mathot et al., 2016)

80 days storage

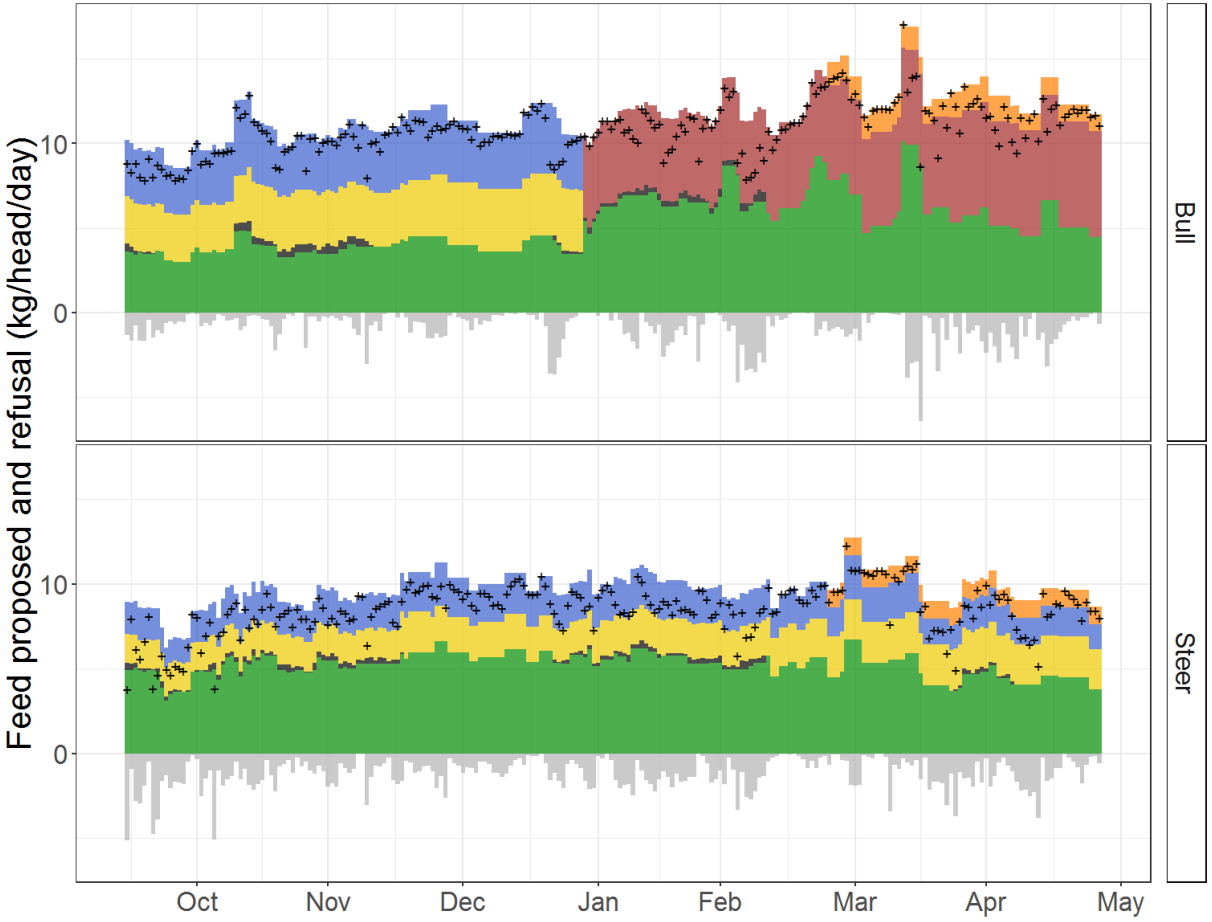
$CH_4$, $N_2O$, $NH_3$

IPCC and GWP

=> $CO_2eq$

# Methodology

Lower performances potential for steers => more grass and less rich diets during growing and finishing phases.




Bought concentrate for finishing

Mainly local resources
70 % grass based products in growing phase and 52 % finishing

# Results

- Diets

| Stage | State | VEVI | DVE | OEB | Crude prot | NDF | ADF |
|---|---|---|---|---|---|---|---|
| | | g/kg dmi | | | | | |
| Growing | Bull | 916±35 | 62±10 | 16±4 | 149±4 | 393±27 | 241±11 |
| | Steer | 863±22 | 61±6 | 16±3 | 145±2 | 420±3 | 261±0 |
| Finishing | Bull | 1032±10 | 75±1 | 33±3 | 176±3 | 305±14 | 195±6 |
| | Steer | 921±9 | 76±1 | 26±1 | 170±3 | 385±5 | 244±3 |

# Results

## Perfomances

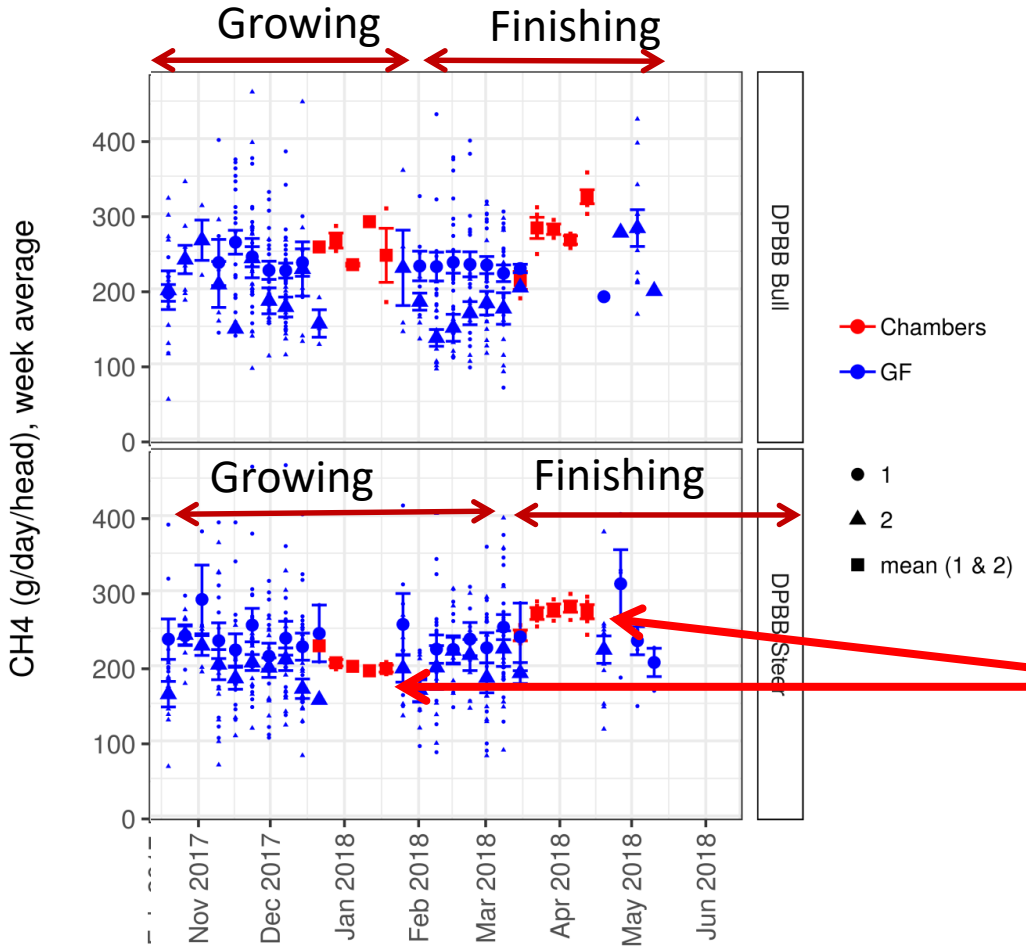
- No evidence of breed effect
- Differences between bulls and steers

| Stage | State | Age at start (month) | Stage duration (month) | Weight at start of the phase (kg/head) | Dlwg (kg/d/head) | CI (kg DMI/kg lwg) | CI Grass (kg DMI/kg lwg) |
|---|---|---|---|---|---|---|---|
| Growing | Bull | 19±2 | 2.7±0.6$^{a}$ | 504±33 | 1.32±0.22$^{a}$ | 8.3±1.4$^{a}$ | 4.4±2.3$^{a}$ |
| | Steer | 19±3 | 4.7±0.7$^{b}$ | 477±39 | 0.91±0.12$^{b}$ | 11±1.3$^{b}$ | 7.9±2.1$^{b}$ |
| Finishing | Bull | 22±2$^{a}$ | 3.6±0.3 | 614±23 | 1.48±0.2$^{a}$ | 7.6±1$^{a}$ | 4±0.6$^{a}$ |
| | Steer | 24±2$^{b}$ | 3.2±1.2 | 602±46 | 1±0.35$^{b}$ | 11.3±3$^{b}$ | 5.8±1.6$^{b}$ |

| Stage | State | Age (month) | Weight (kg/head) | Dlwg (kg/d/head) |
|---|---|---|---|---|
| Slaughter | Bull | 25±2$^{a}$ | 774±19$^{a}$ | 1.40$^{a}$ |
| | Steer | 27±3$^{b}$ | 690±53$^{b}$ | 0.9$^{b}$ |

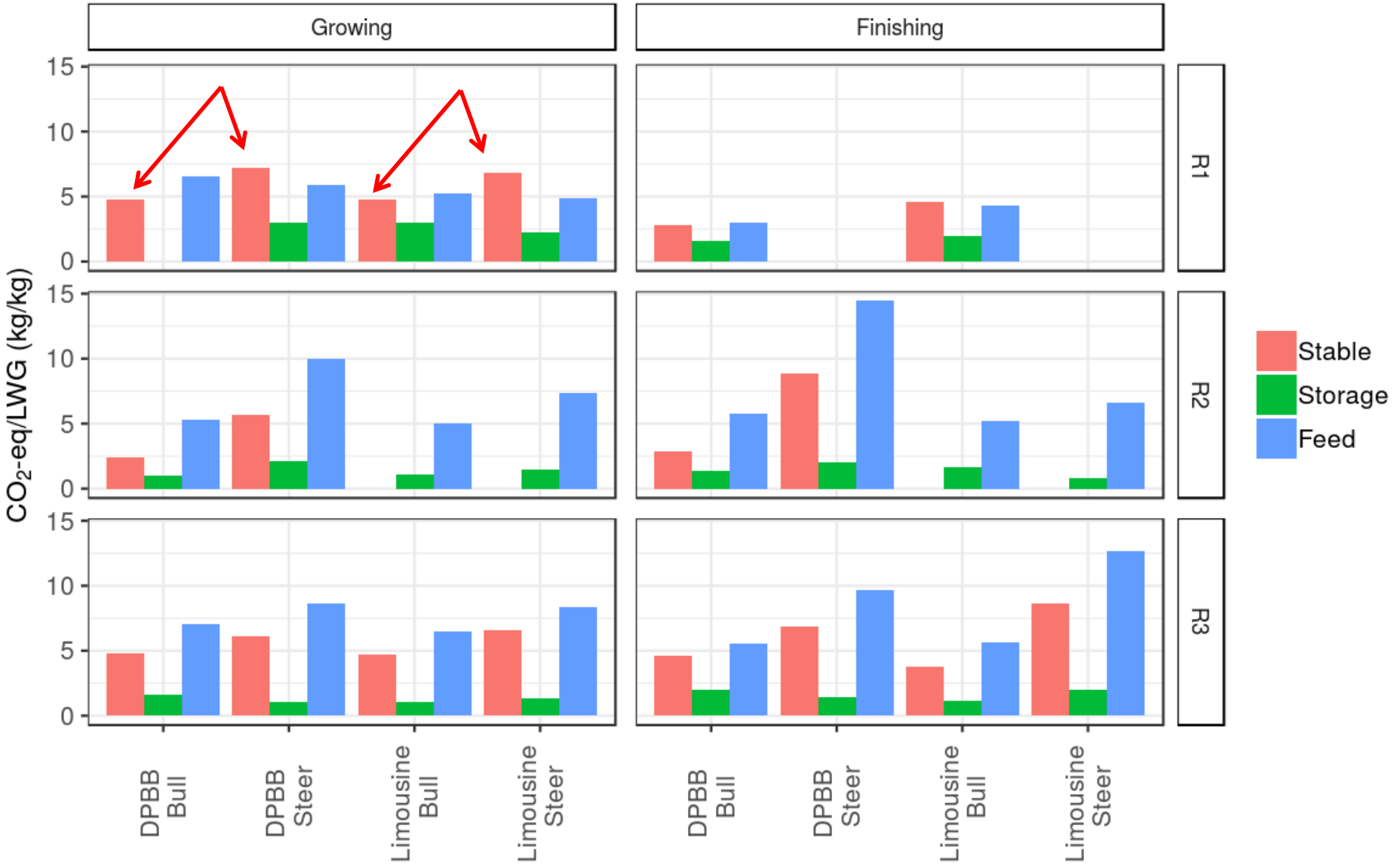
# Results

## GHG emissions

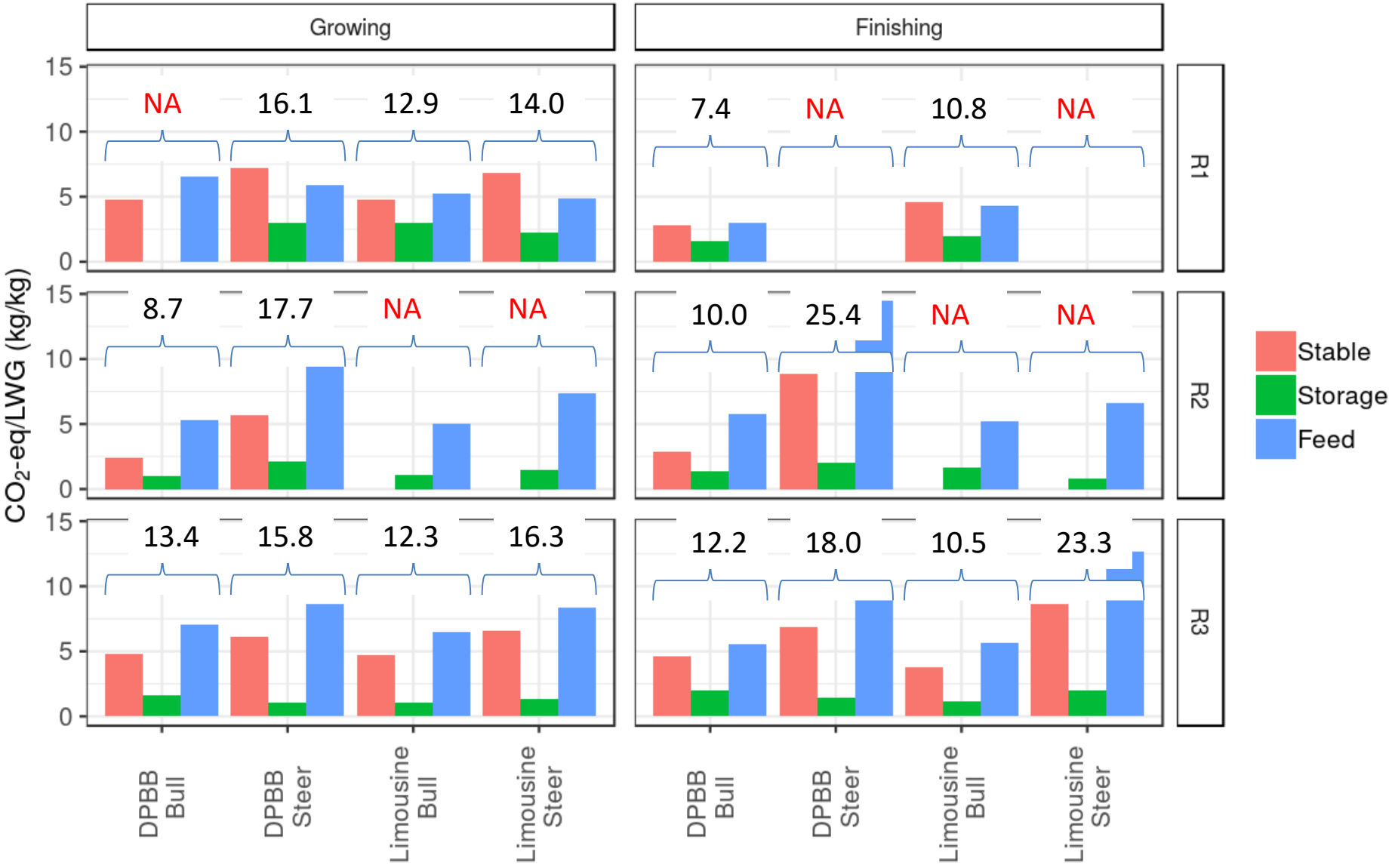



Focus on chambers with data extrapolated on the whole phase (emission/kg DMI)

# Emissions in $CO_2$ eq per kg lwg as measured in chambers extrapolated to whole growing and fattening phases



# Emissions in $CO_2$ eq per kg lwg as measured in chambers extrapolated to whole growing and fattening phases



# Results

- Higher GHG emissions from steers (**G: 16.0 (0.7), F: 22.2 (2.2)** ) compared to bull (**G: 11.8 (1.5), F: 10.9 (0.7)** ) in kg $CO_2$ eq per kg of liveweight produced.

- How much C should sequestrate the grassland used to produce the grass based products (grass silage), ingested in higher amount by steers, to compensate the differences observed?

| | | Steer-Bull | | | C sequestration in grassland to compensate the difference in GHG emissions (yield of 7 t DM/ha) |
|---|---|---|---|---|---|
| | n | kg $CO_2$eq/ kg lwg; mean (sem) | p (t.test=0) | % | t C/ha/year; mean (sem) |
| Growing | 4 | 4.1 (1.4) | 0.05 | 41% | 2.0 (0.5) |
| Finishing | 3 | 11.3 (2.0) | 0.10 | 108% | 12.8 (2.6) |

# Conculsion

- Trend in more GHG emissions for steers compared to bulls per kg lwg, whatever the breed.

- Limitations and perspective:
  - Repetition
  - Accuracy of feed production impact
  - Include animal emissions when grazing
  - $CH_4$ measures with Greenfeed to check consistency

- Other concern:
  - Autonomy and Food/Feed competition (C. Battheu, boa p.144 and 200)
  - Ammonia emissions
  - Biodiversity

- Other production scheme
  - Rose veal (A. Mertens, boa p. 640)