Institute of Agricultural and Nutritional Sciences

Martin – Luther – University Halle – Wittenberg

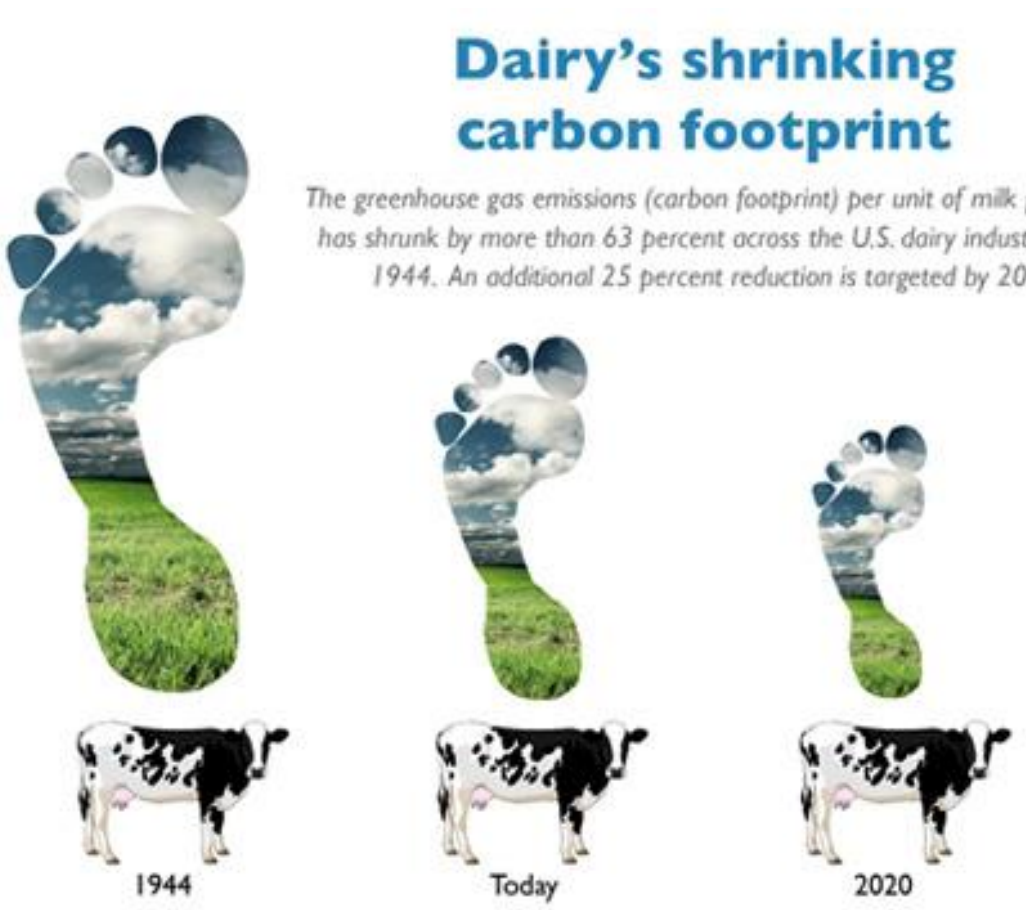
66th EAAP Annual Meeting

Effects of culling rates on measures of ecological sustainability in dairy cattle

Stephan Ebschke, Eberhard von Borell

Animal husbandry and ecology

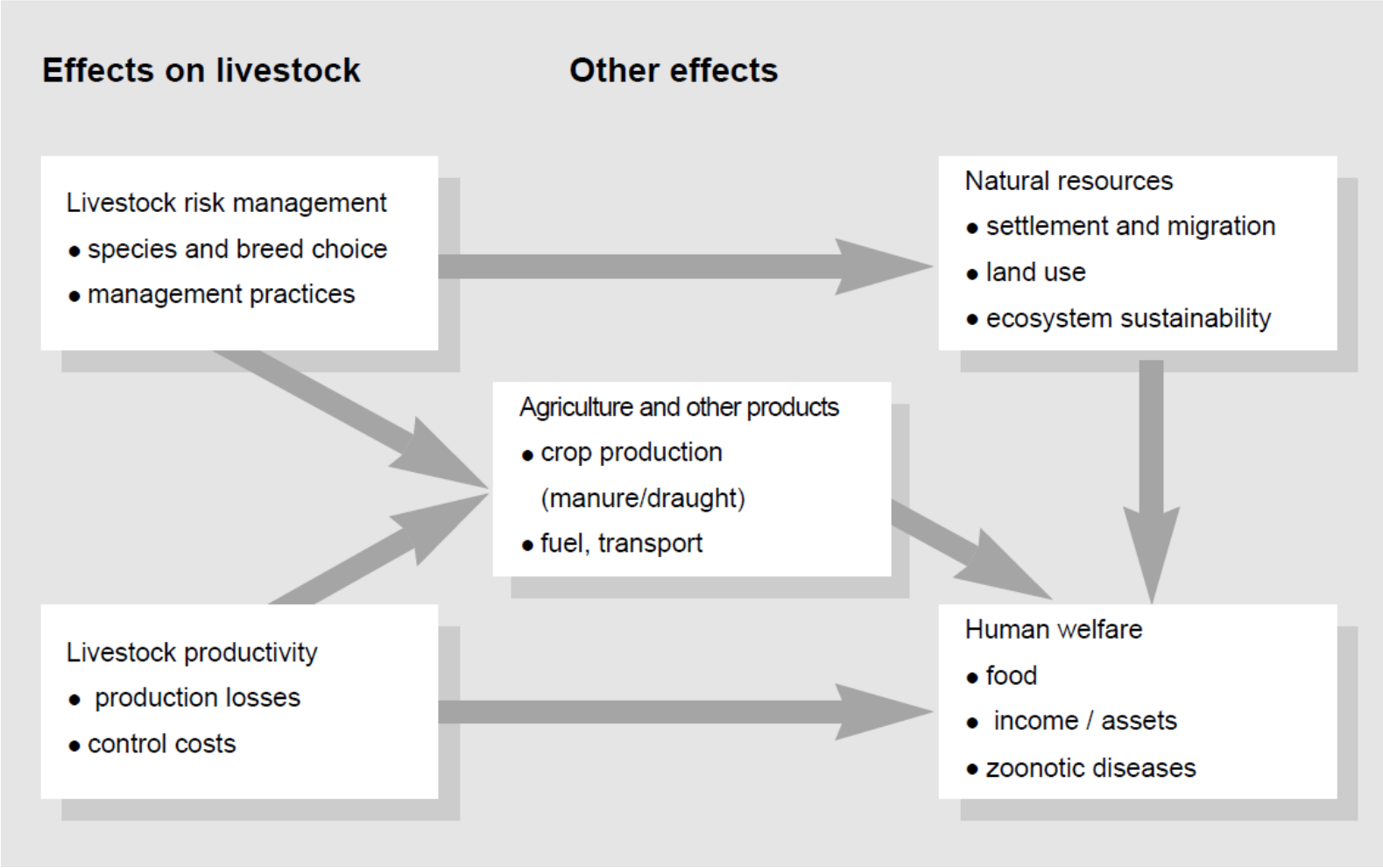
„The innocence of purchasing dairy products“



Introduction I

- Ecological sustainability and animal welfare in the field of food production
- Increasing social and public topic
- National fertiliser ordinance regulate use of organic manure
- Product linked carbon footprinting (CF) becomes common for food goods
- Food safety, quality and the ecological consequences associated with its production become similar impact for consumer

Multiple effects of animals disease on livestock, agricultural production, natural resources and human welfare in farming systems (Swallow 2000)

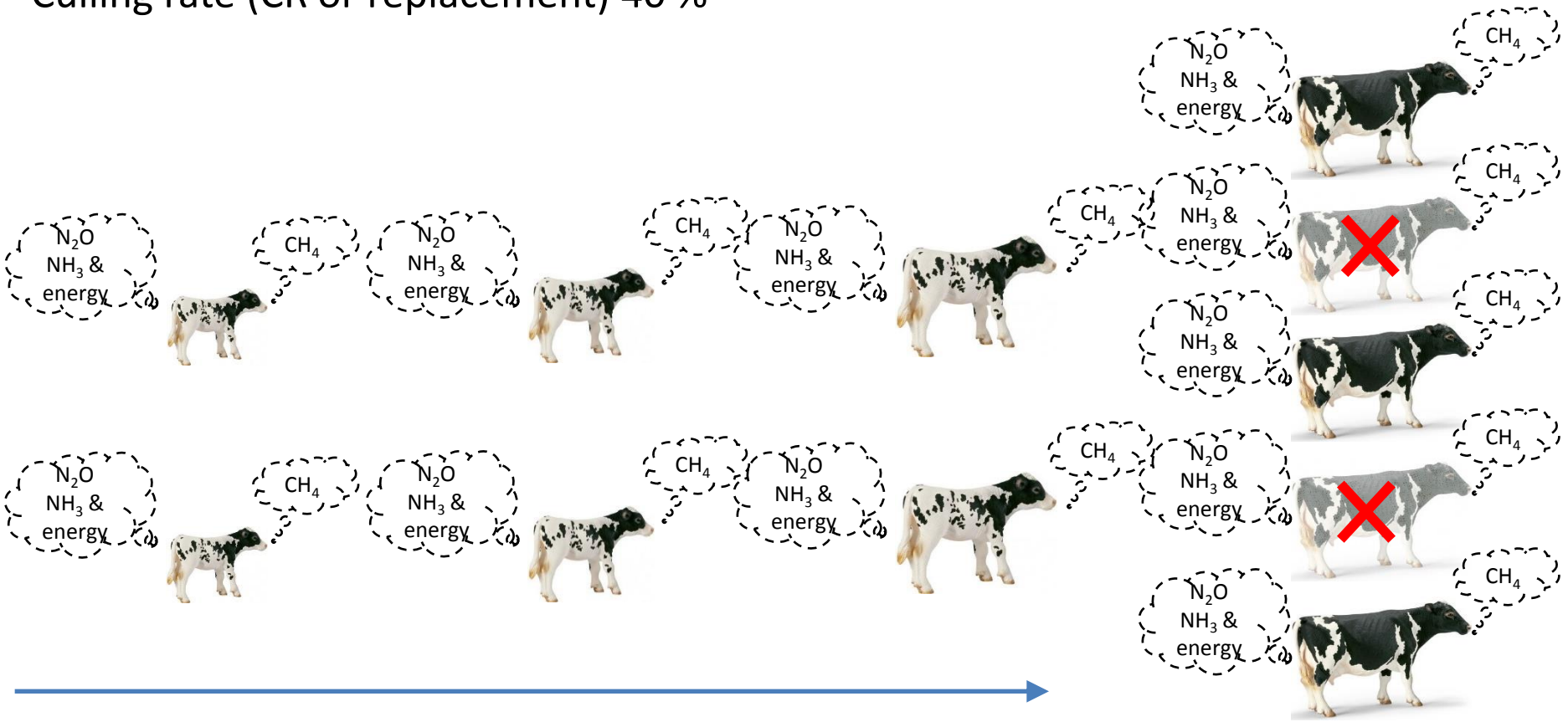


Introduction II

- Cullings for animal welfare reasons main source of bad publicity for dairy and beef production
- Factors that influence culling rate (CR): management style, herd expansion, herd management software, type traits, SCS, crossbreeding, economic evaluation
- leads to higher proportion of cows in more profitable lactations (Gill et al. 2010, Rushen 2013)

Introduction III

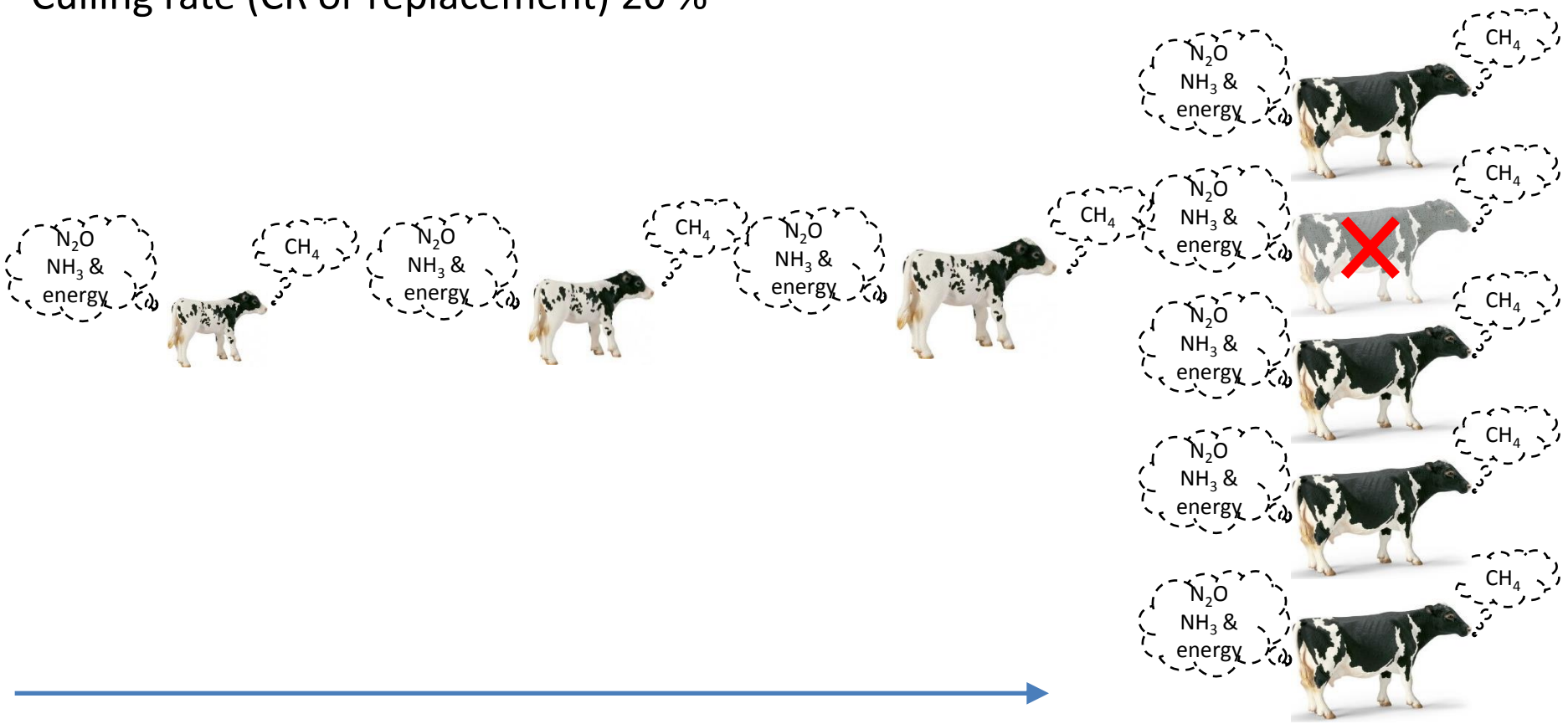
Culling rate (CR or replacement) 40 %



24 month ~2 t CO_2-eq/calf/year ~0.8 t CO_2-eq/cow/year

Introduction III

Culling rate (CR or replacement) 20 %



24 month ~2 t CO_2-eq/calf/year ~0.4 t CO_2-eq/cow/year

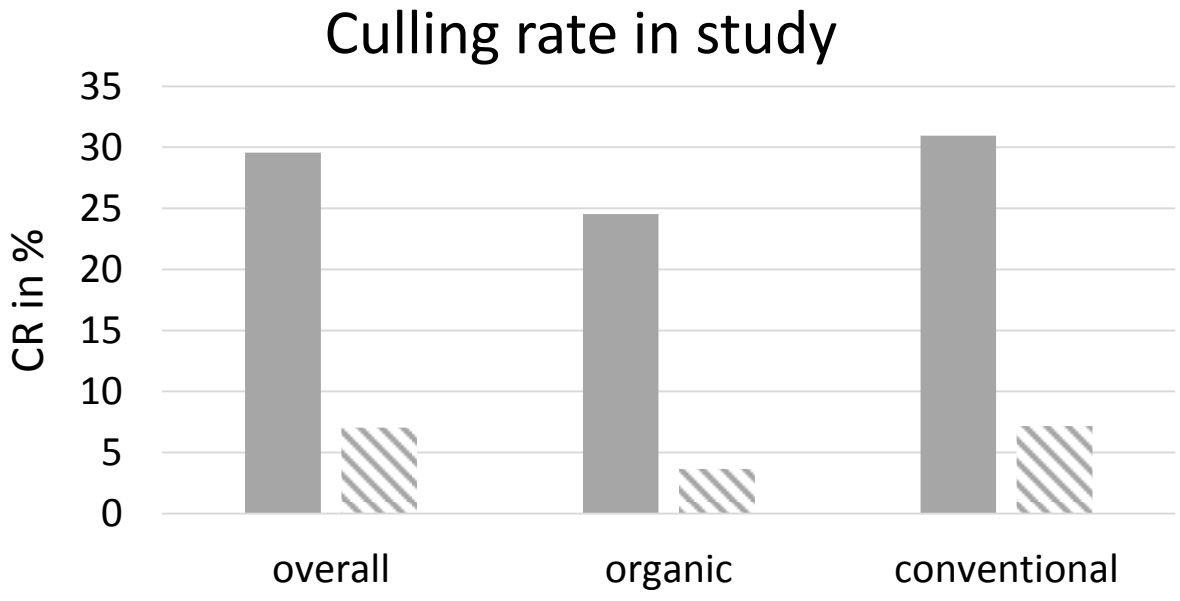
Material und methods I

- Data from 22 dairy cattle farms
- 17 conventional und 5 organic
- different farmtypes and herd sizes (36 to 1600 dairy cows)
- Feeding varies due to regional and systemic specifics
- varying systems: housing, milking, pasture, litter, manure storage, energy intensity

Material und methods II

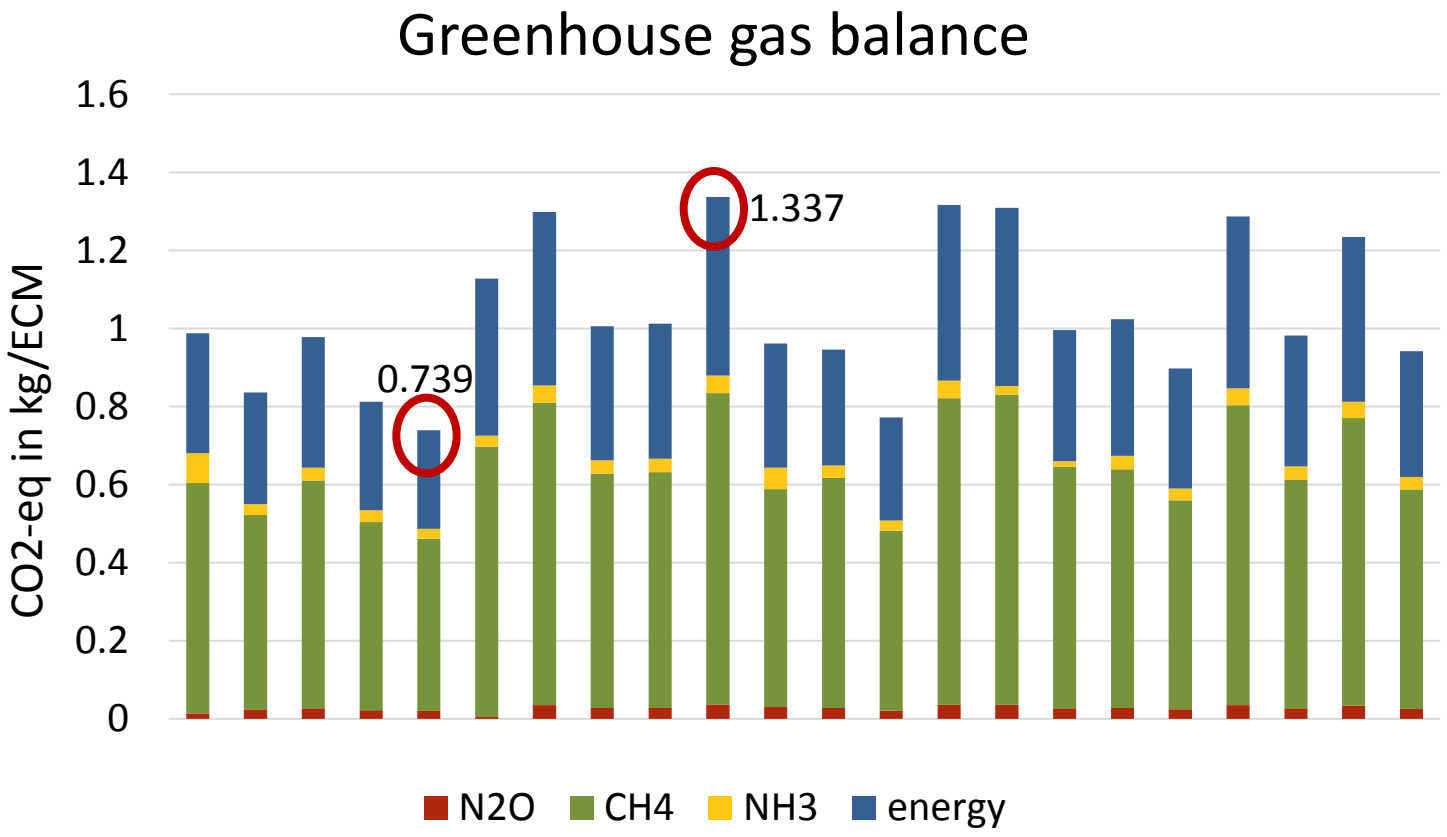
- Calculation of substance flows and metabolic effects
- Outputs of methane (CH_4), ammonia (NH_3), nitrous oxide (N_2O) and energy intensity (CO_2-eq)
- Individual farm related and on-farm generated data
- Adaptation of methodology of Rösemann et al. (2013) and IPCC (2006) using TIER 2 and 3 methods
- EF from literature or calculated from available data
- determine CR to estimate GW reduction potential
- Standardization for required progeny and target CR (3 % losses)

Results I

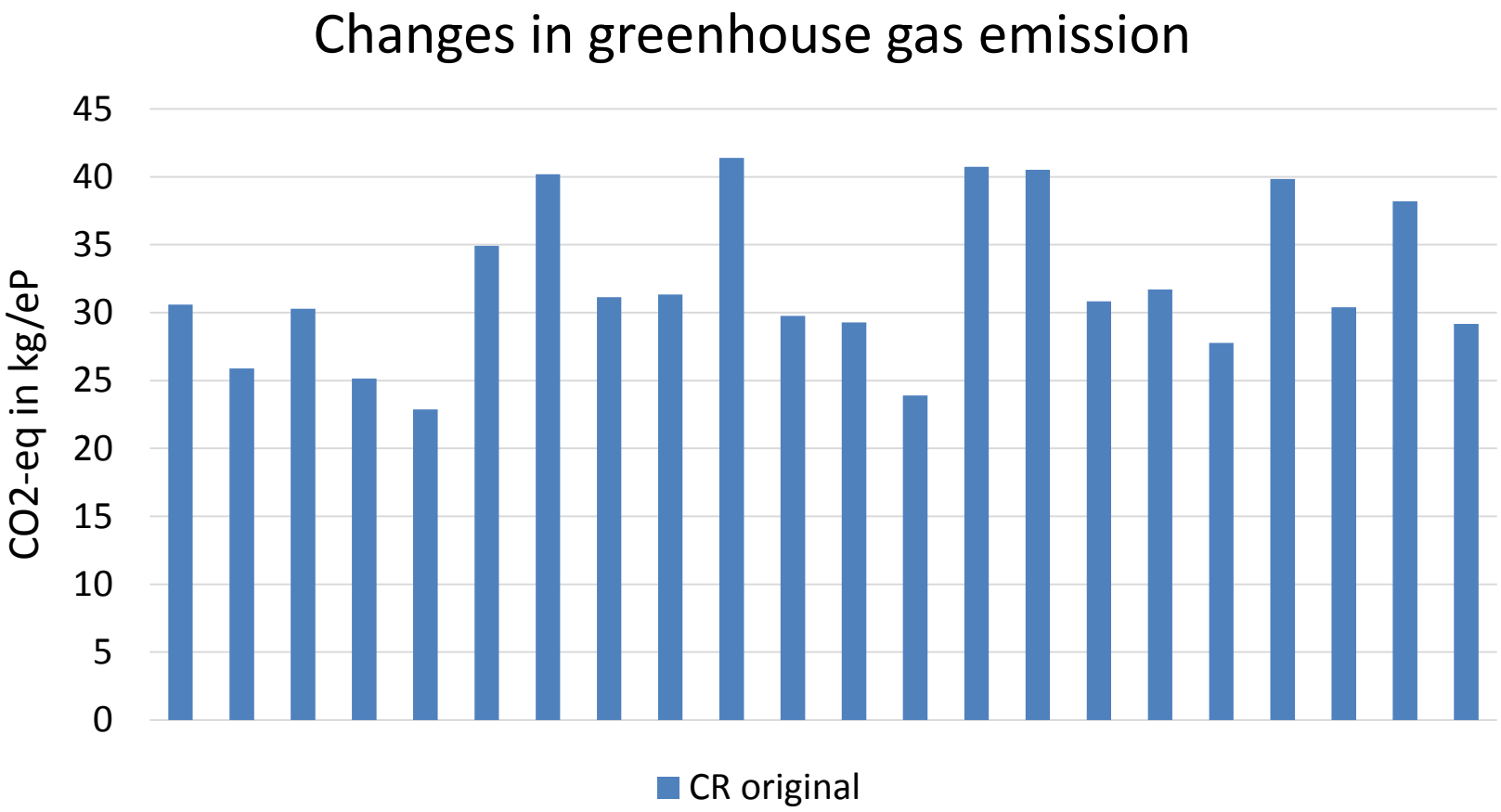


mean	29,56	24,52	30,96
SD	7,04	3,67	7,18
min	16,9	19,8	16,9
max	44	28,7	44

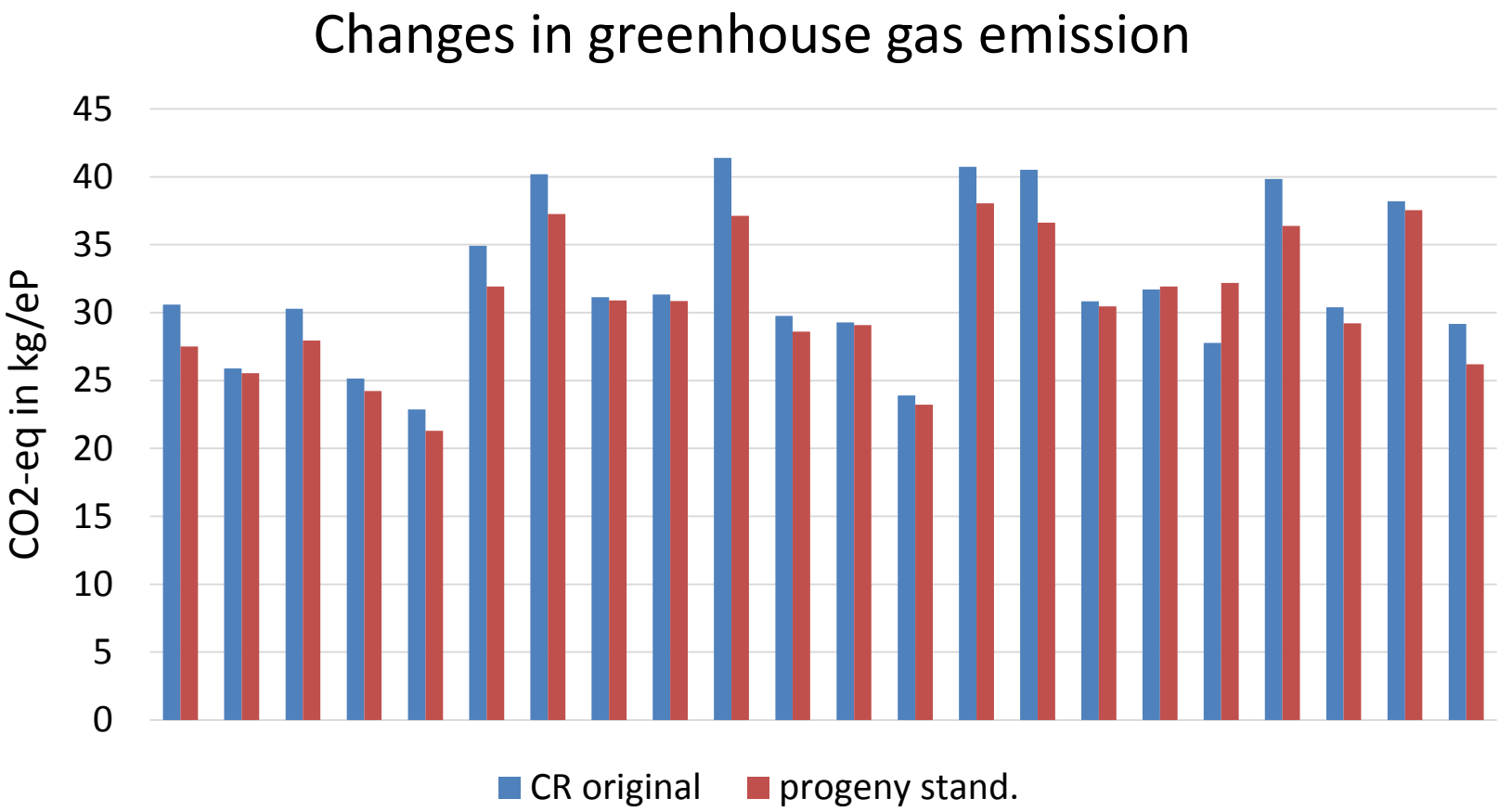
Results II


Greenhouse gas balance
CO2-eq in kg/ECM
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.739
1.337
N2O
CH4
NH3
energy

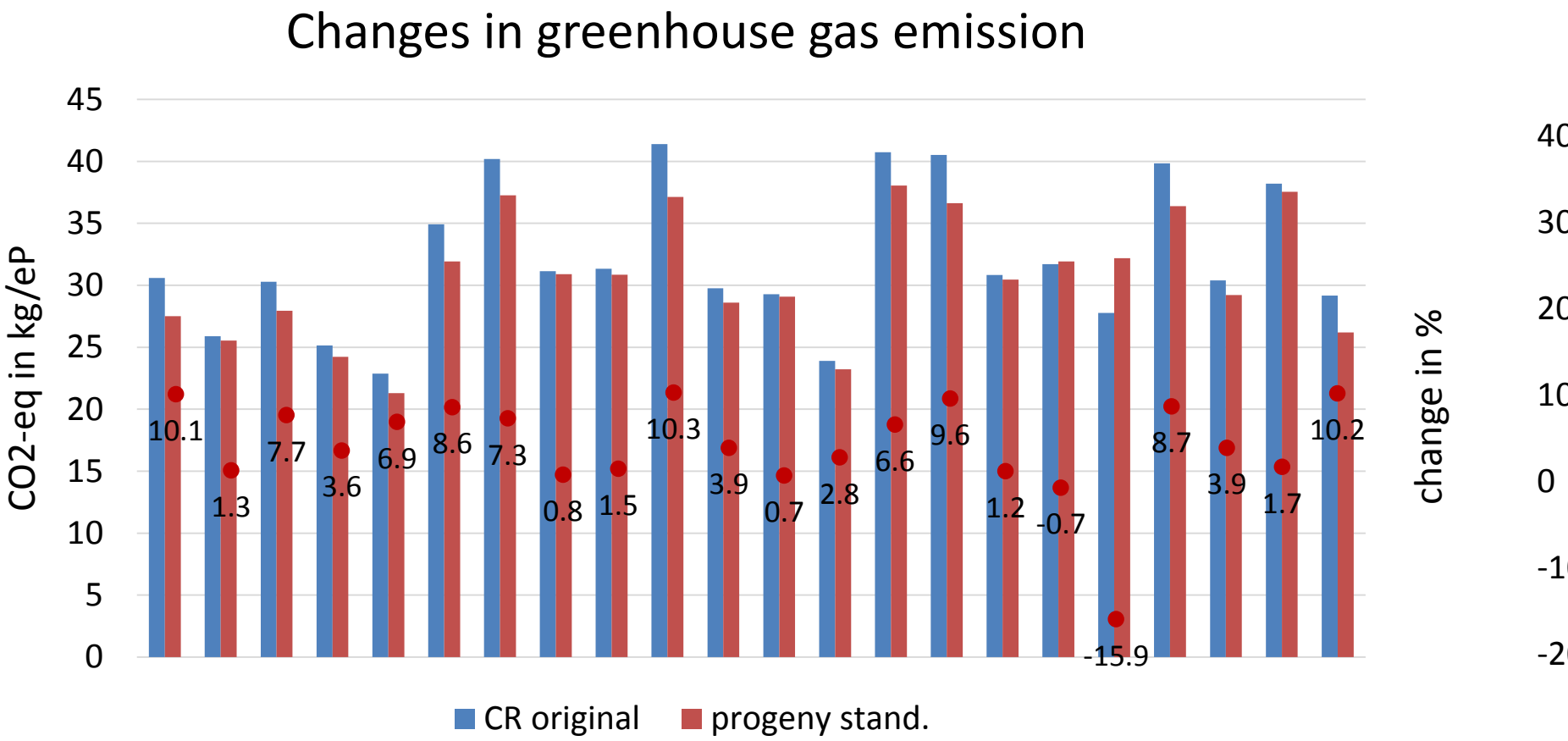
Results III


Changes in greenhouse gas emission
CO2-eq in kg/eP
45
40
35
30
25
20
15
10
5
0
CR original

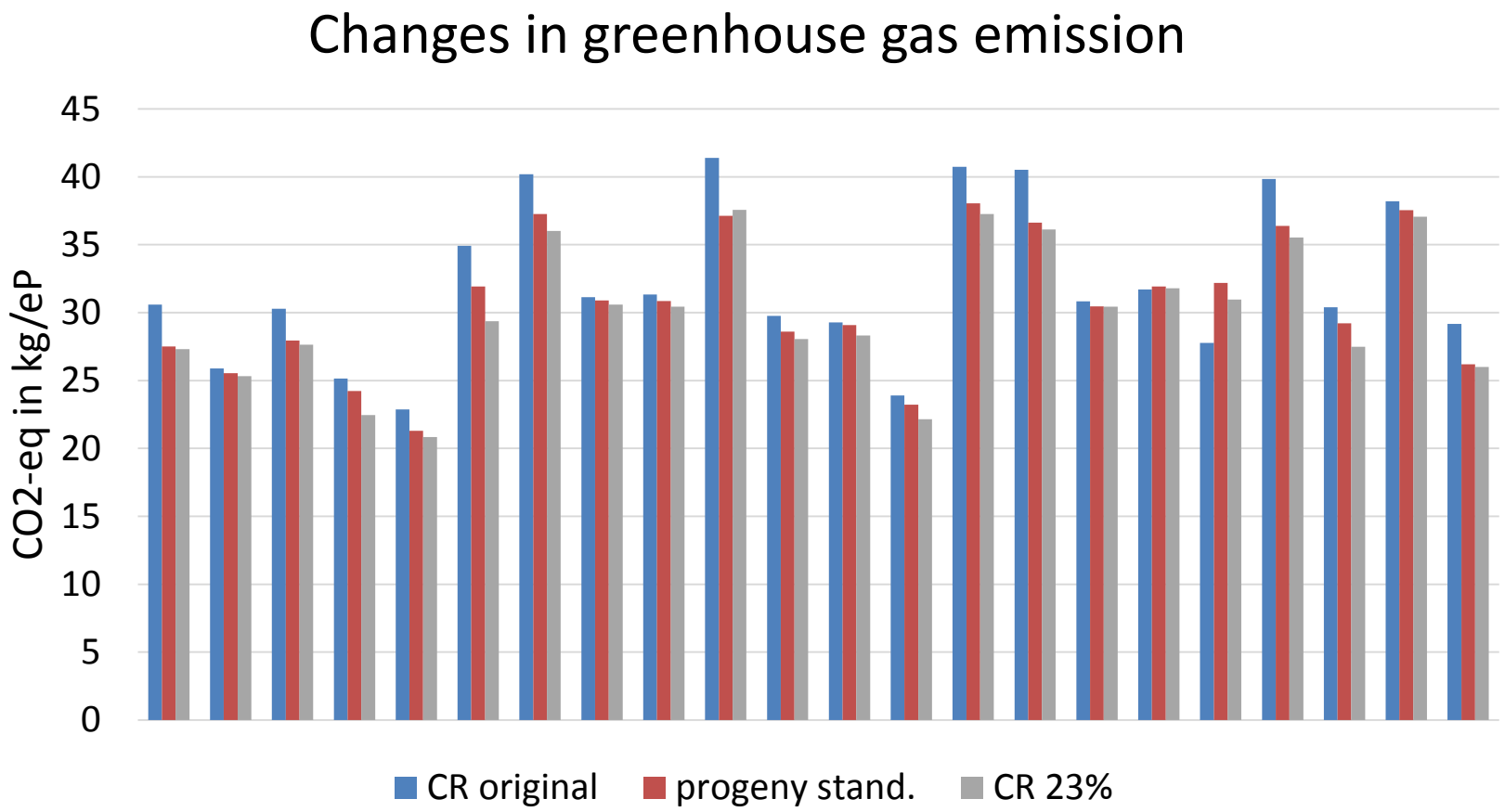
Results III


Changes in greenhouse gas emission
CO2-eq in kg/eP
45
40
35
30
25
20
15
10
5
0
CR original
progeny stand.

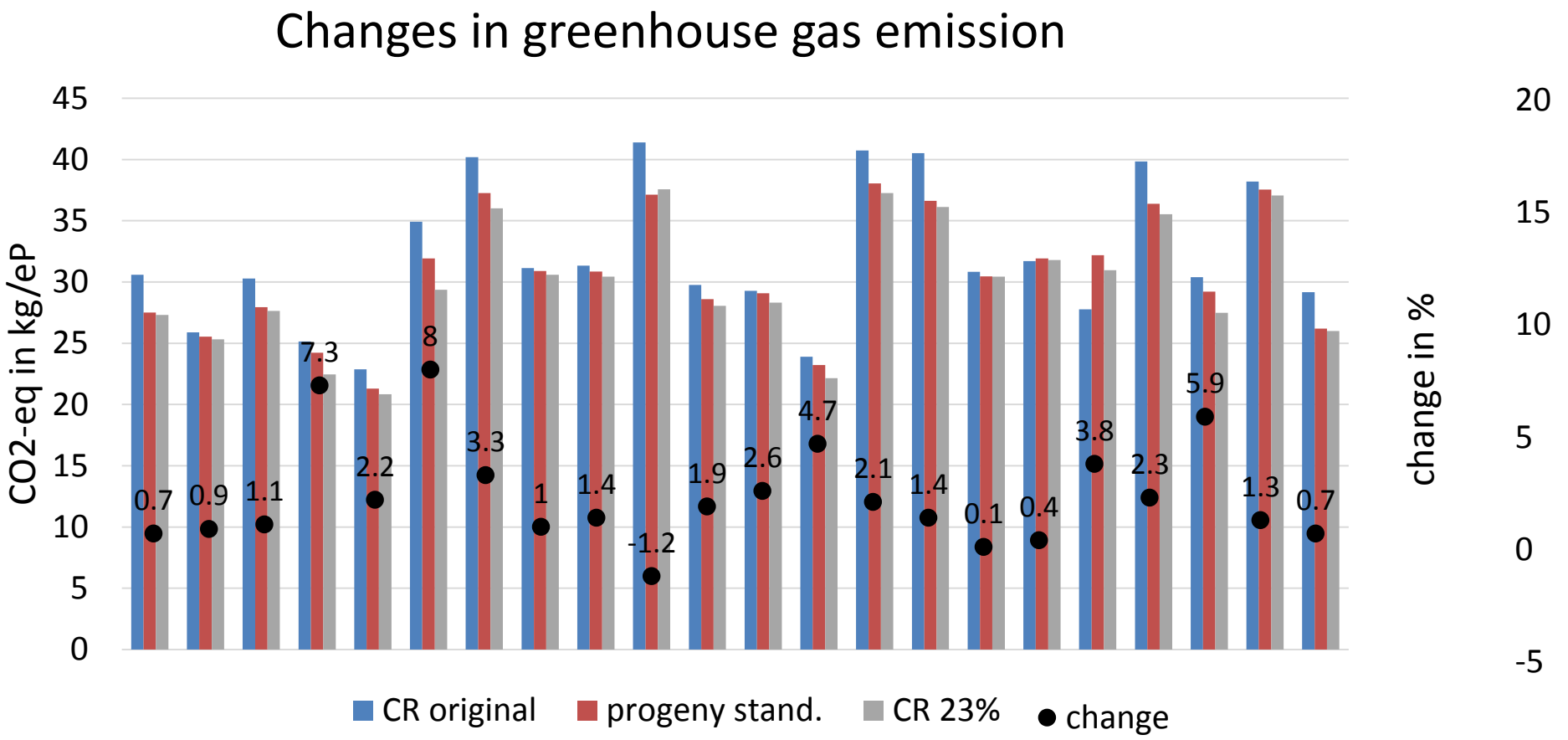
Results III


Changes in greenhouse gas emission
CO2-eq in kg/eP
change in %
45
40
35
30
25
20
15
10
5
0
40
30
20
10
0
-10
-20
10.1
1.3
7.7
3.6
6.9
8.6
7.3
0.8
1.5
10.3
3.9
0.7
2.8
6.6
9.6
1.2
-0.7
-15.9
8.7
3.9
1.7
10.2
CR original
progeny stand.

Results III


Changes in greenhouse gas emission
CO2-eq in kg/eP
45
40
35
30
25
20
15
10
5
0
CR original
progeny stand.
CR 23%

Results III


Changes in greenhouse gas emission
CO2-eq in kg/eP
change in %
45
40
35
30
25
20
15
10
5
0
20
15
10
5
0
-5
0.7
0.9
1.1
7.3
2.2
8
3.3
1
1.4
-1.2
1.9
2.6
4.7
2.1
1.4
0.1
0.4
3.8
2.3
5.9
1.3
0.7
CR original
progeny stand.
CR 23%
change

Discussion

- wide range in CF for dairy caused by specifics of farms
- Changes in carbon footprints possible in most dairy farms

  either leads to higher reduction potential by lowering rearing intensity, decreasing CR itself or both
- must be seen as a threshold value for animal welfare
- further focus on other supressive relation to performance

  (illness, sickness, management, behave, poor welfare at all)

Conclusion

- high potential to reduce CF of dairy products
- Contribution to mitigate animal related emission and clime targets
- decreased CR benefit for consumers perception
- Improvement of economical profit
- high CR most visible symptom of a larger problem of poor cow health and welfare
- reducing underlying causes not discouraging producers to cull obviously ill animals

Thank you for your attention!

stephan.ebschke@landw.uni-halle.de