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Morphology and body composition of beef-on-dairy heifers along compensatory growth itinerary

EAAP 2023
Lyon
August 30th

With the support of:

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The Swiss Regio-Beef Project

Efficiency of beef cattle production system adapted to the production site

Trial 1

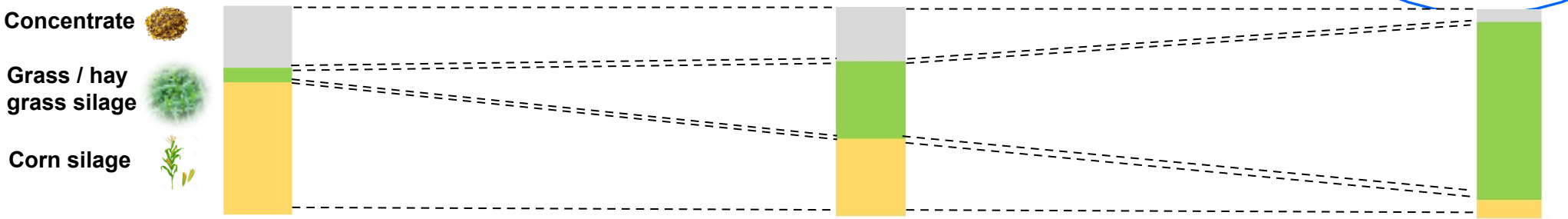
Lowland region
Intensive diets

Trial 2

Hills region
Semi-intensive diets

Trial 3

Mountain region
Semi-extensive diets



Feed efficiency, economic and environmental performance and product quality

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Producing meat on a grassland basis

Advantages such as:

- Reducing competition feed-food
- Improving nutritional meat quality (omega 3, CLA…)
- Meeting society's expectations in terms of animal health and welfare
- Lower operational costs
- Providing ecosystemic services

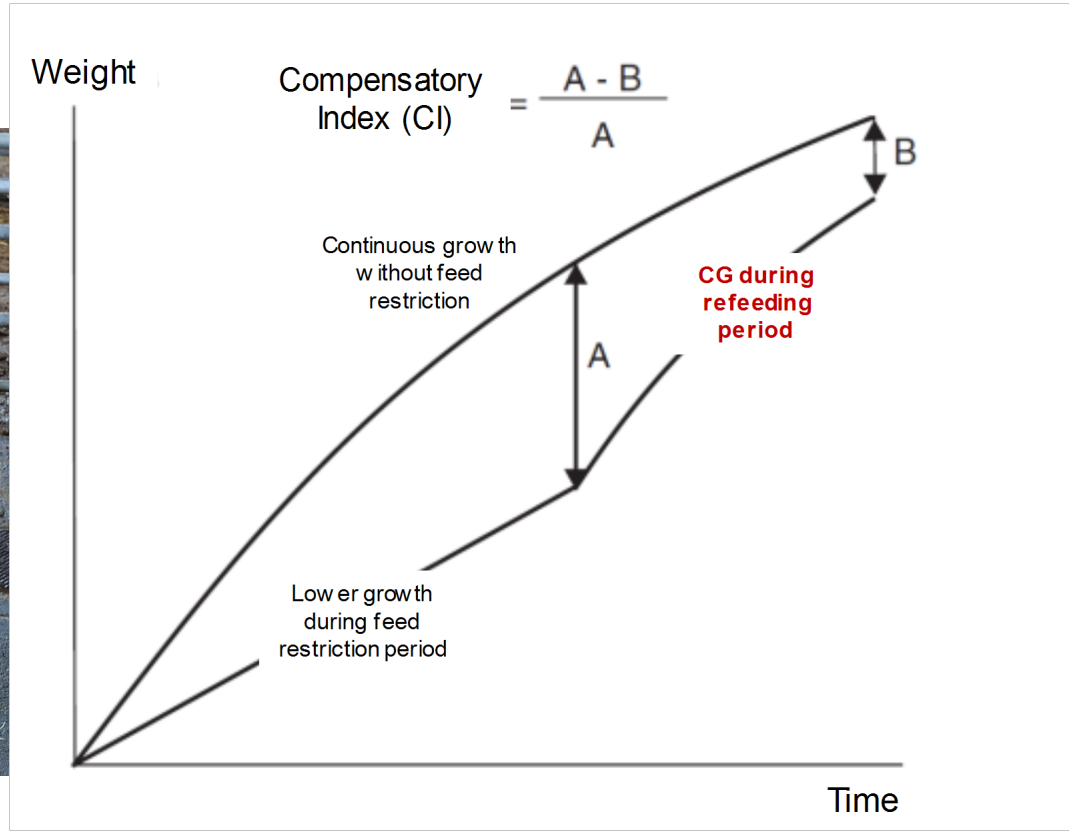
More sensitiv to hazards such as:

variability along and within years in the availability of feed resources in terms of quantity and nutritive value of grass

→ **episodic feed restriction challenges**

enhanced by the increasingly frequent occurrence of extreme climatic events

Compensatory growth (CG)



Hoch et al., 2003

The intensity of compensatory growth is influenced by:

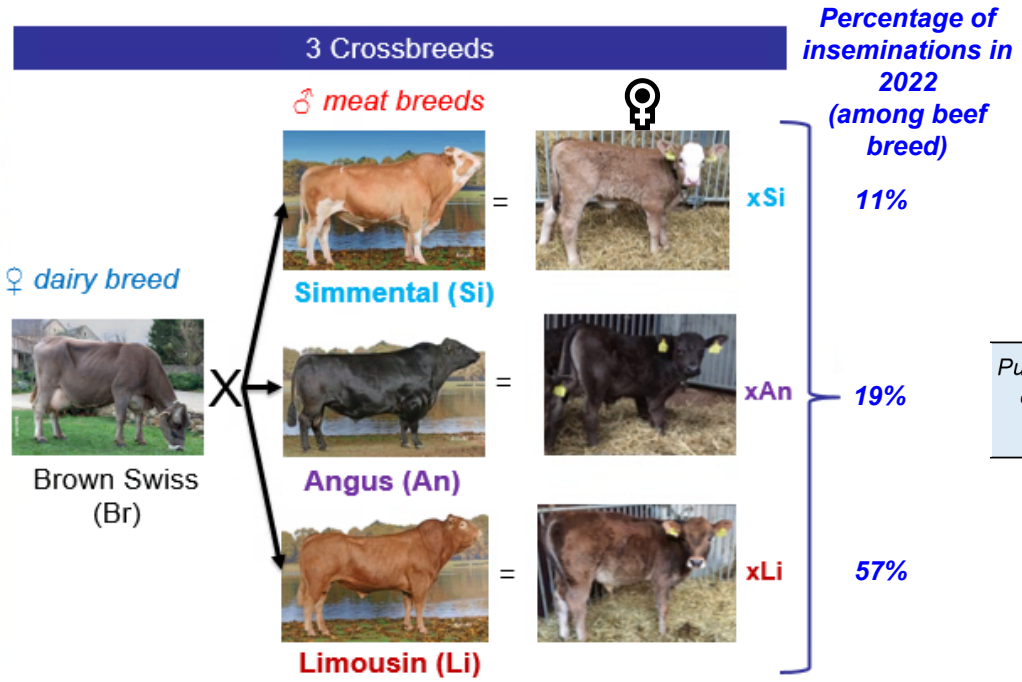
- Age
- Severity of restriction
- Length of the restriction
- Nature of the restriction

Research question

May discontinuously grown heifers compensate fully the effects of feed restriction at the same slaughter weight than continuously grown heifers?

in terms of body morphology and composition as well as carcass quality

Experimental design

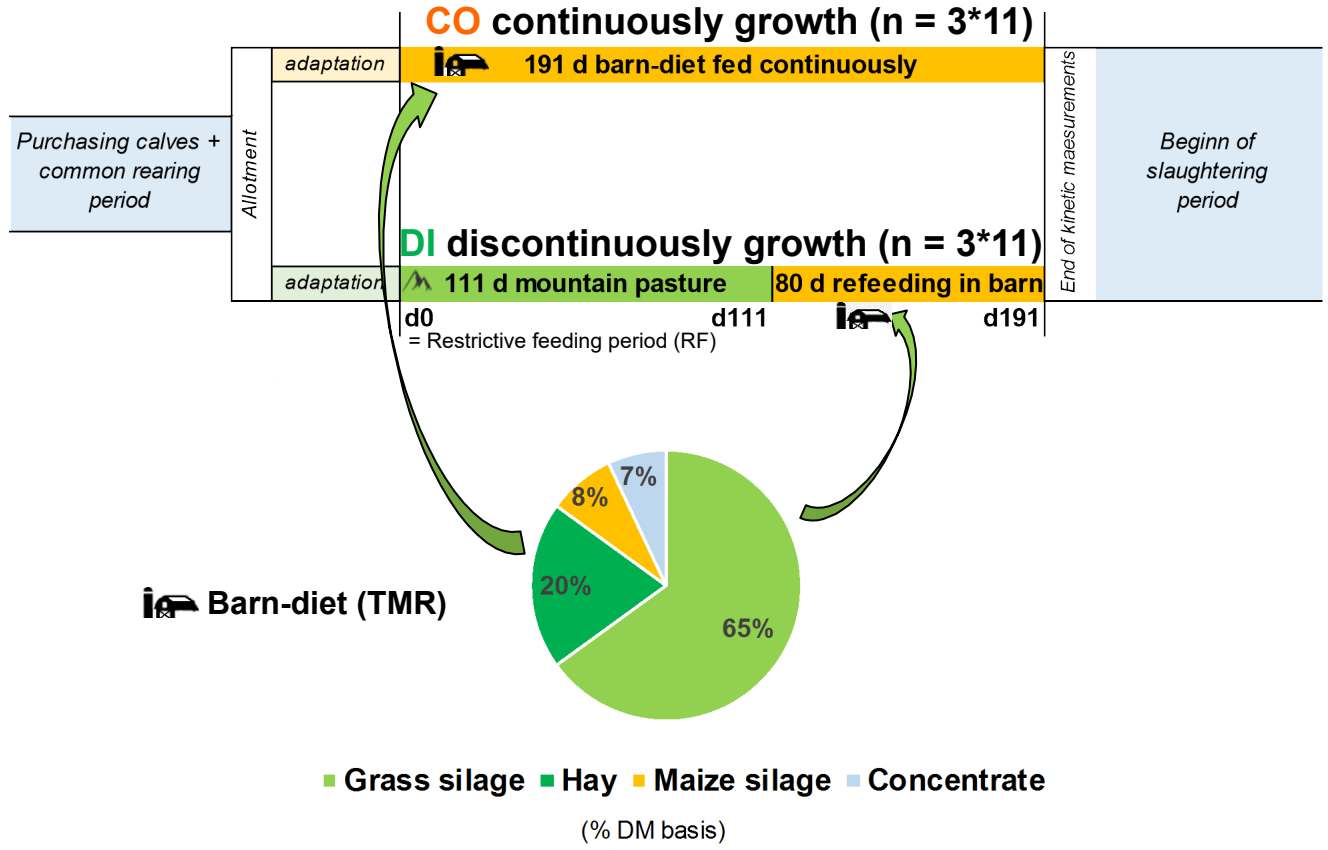


66 heifers

271 - 527 kg BW

(+ 18 additional heifers for serial slaughtering)

2 treatments: CO and DI



35% of the meat produced in Switzerland comes from beef–on-dairy

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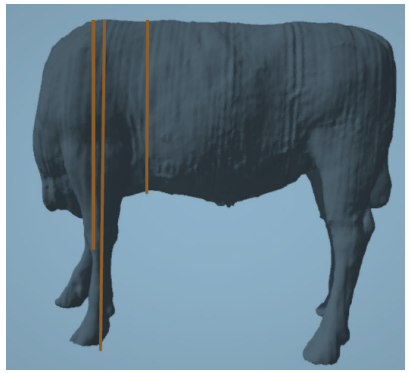
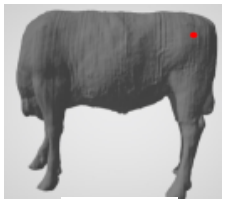
Materials & Methods

Full body 3D imaging

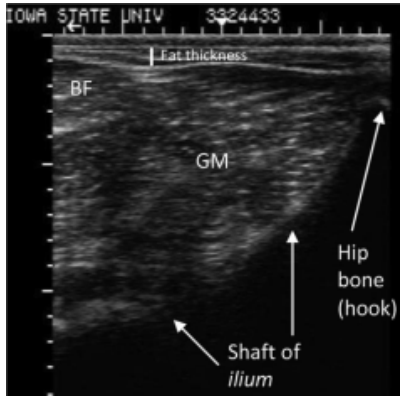


Ultrasound (dorsal and rump)

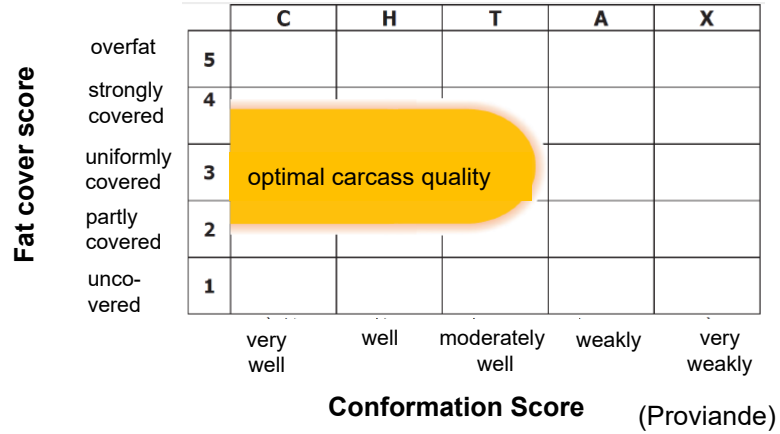
dorsal



rump



Grading (CH-TAX) by trained operators



(Proviande)

by 12 heifers (4 xSi, 4 xAn, 4 xLi) of each CO and DI group **d0 – d111 – d191 and before slaughter**

Materials & Methods

Empty body (EB) chemical composition by 30 heifers slaughtered for direct *post mortem* measurements

d0	d111	slaughter
6	6 CO 6 DI	6 CO 6 DI
additional heifers		*heifers from experiment*





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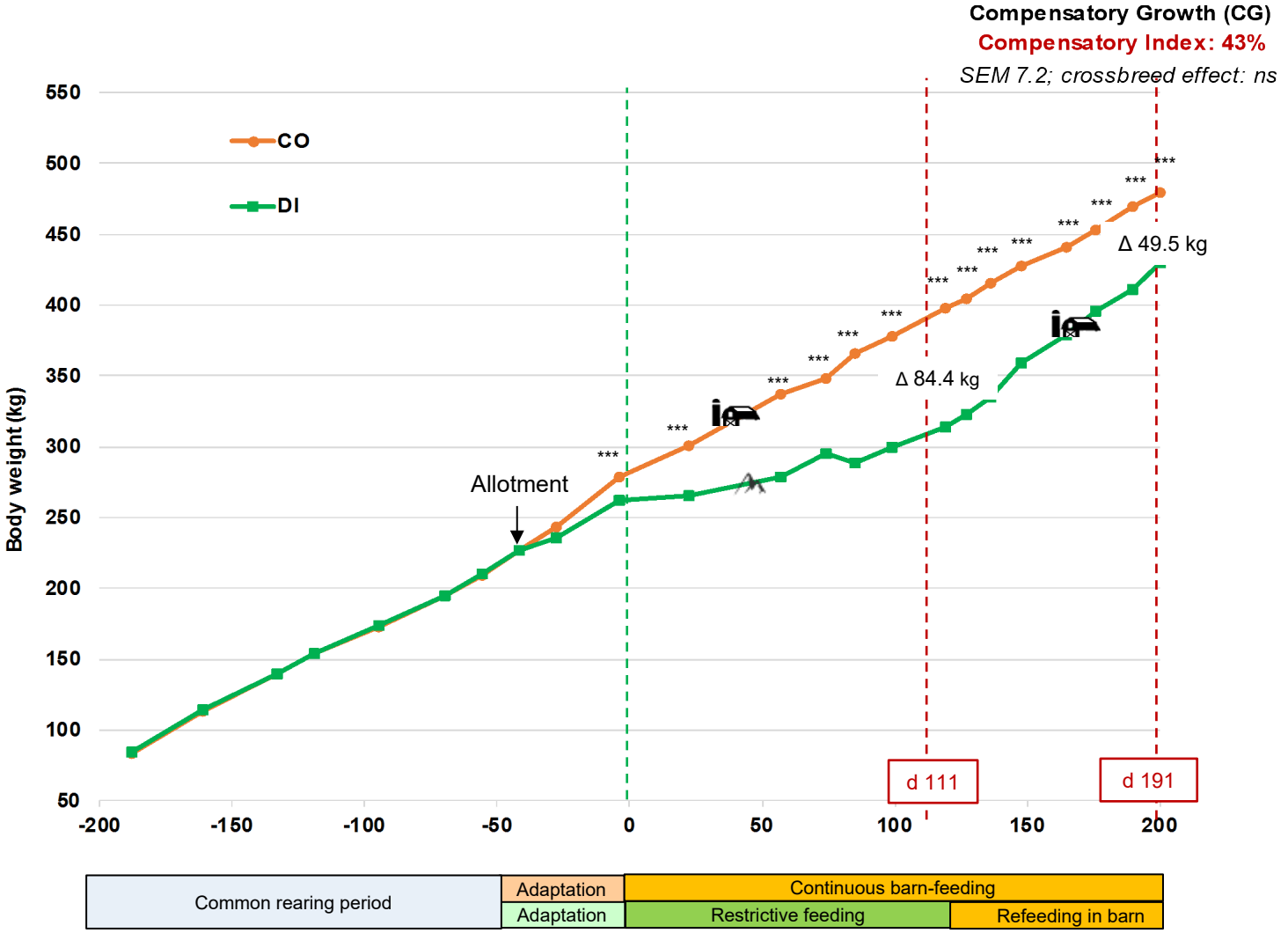
Body weight and average daily gain



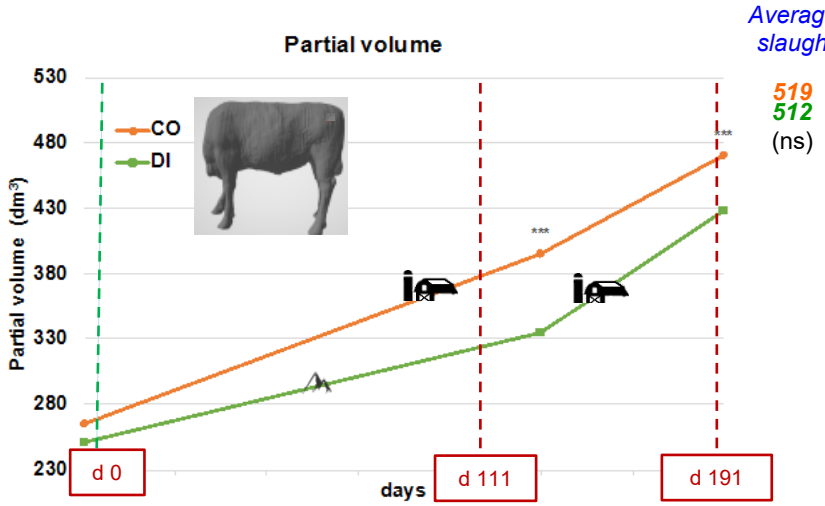
* *P*<0.05; ** *P*<0.01; *** *P*<0.001

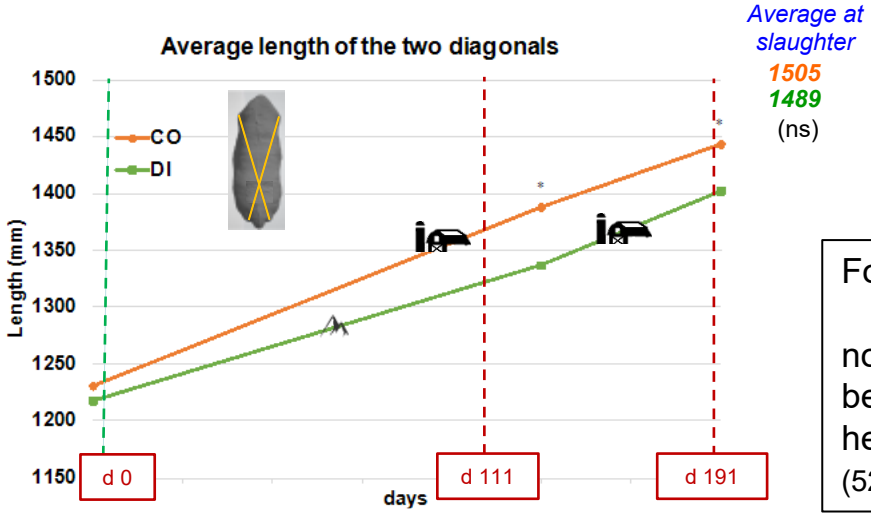
	Average daily gain (kg/d)	
	d 0 - d 111	d 111 - d191
CO	1.06 ± 0.07	1.02 ± 0.15
DI	0.45 ± 0.13	1.46 ± 0.18
P-value		
Treatment	***	***
Crossbreed	ns	**
		An > Li and Si
Interaction T*C	0.054	0.132

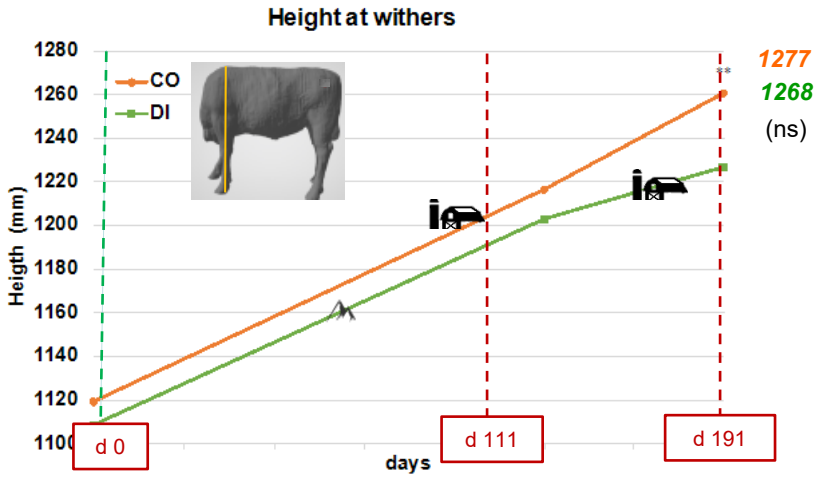
	DM intake and Feed efficiency (FCE) during CG (d 111 - d 191)	
	DMI (kg/d)	FCE (kg ADG / kg DMI)
CO	7.8 ± 0.8	0.13 ± 0.02
DI	8.7 ± 0.7	0.17 ± 0.01
P-value		
Treatment	***	****
Crossbreed	***	ns
	An > Li and Si	
Interaction T*C	0.68	0.11

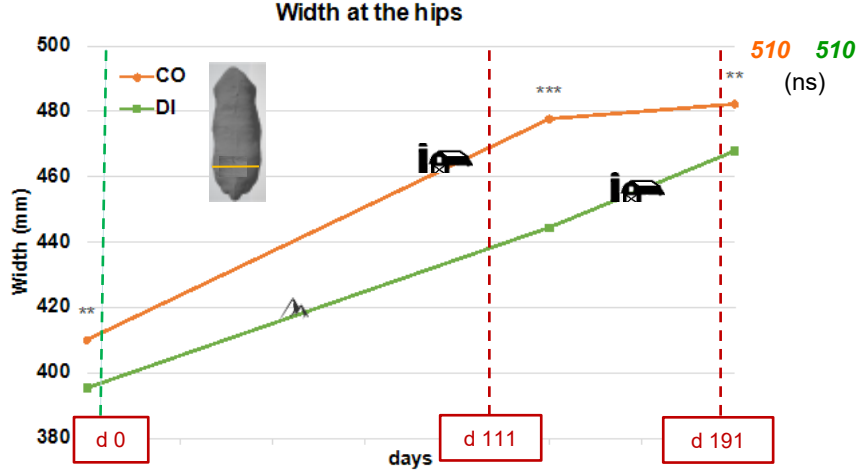
	Days between start of refeeding in DI and slaughter (527 kg BW)
CO	124.6 ± 28.6
DI	160.3 ± 25.7
P-value	
Treatment	***
Crossbreed	**
	An < Li and Si
Interaction T*C	0.77

Morphology by 3D imaging









Continuous barn-feeding
Restrictive feeding | Refeeding in barn

Continuous barn-feeding
Restrictive feeding | Refeeding in barn

For all morphological traits:

no longer difference between **CO** and **DI** heifers at slaughter (527 kg BW ; *P* 0.18 to 0.94).

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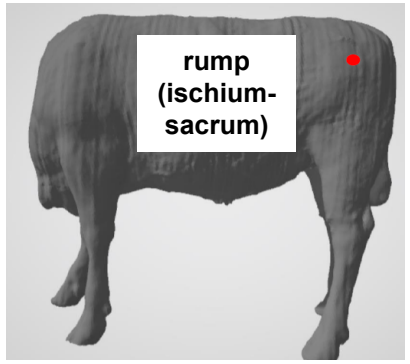
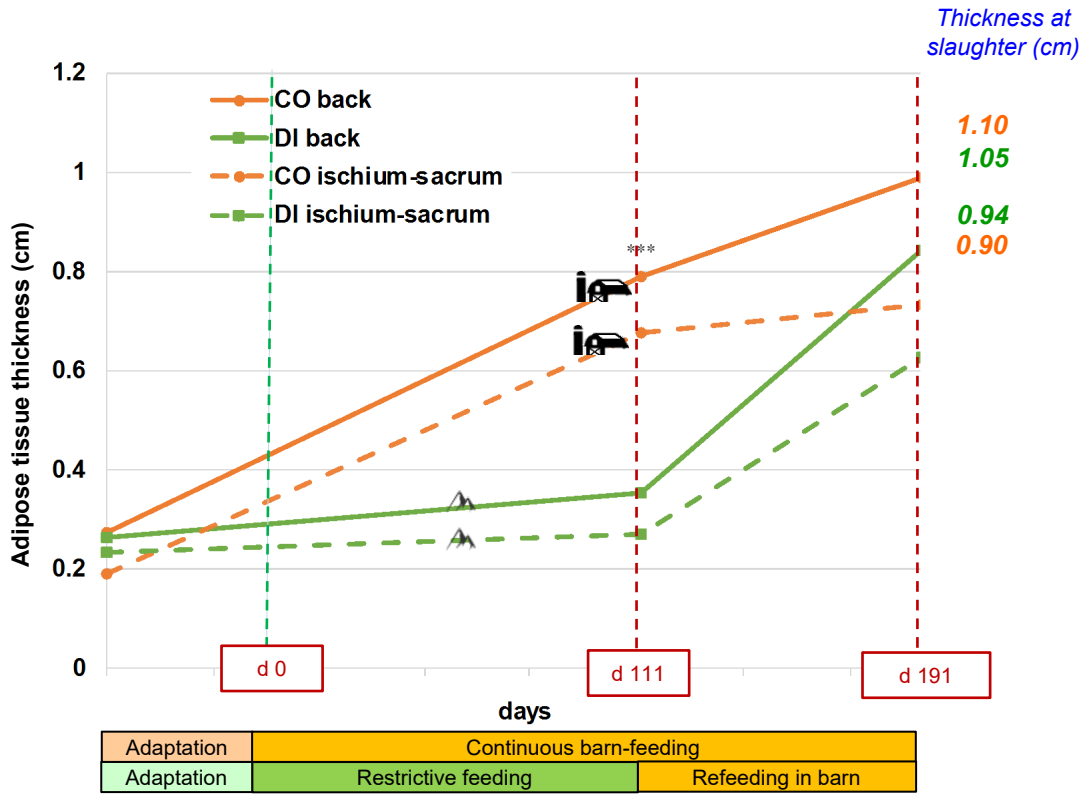
Ultrasounds and lipid & protein in empty body

Thickness of subcutaneous fat measured by ultrasound on 2 different anatomical locations





Lipid in empty body (EB) in % of FM	d 111	Slaughter
CO	17.3 ± 3.9	24.7 ± 2.6
DI	9.0 ± 2.6	23.9 ± 3.2
P-value		
Treatment	***	ns
Crossbreed	**	t (*P*=0.11)
	An > Si and Li	
Interaction T*C	0.48	0.16

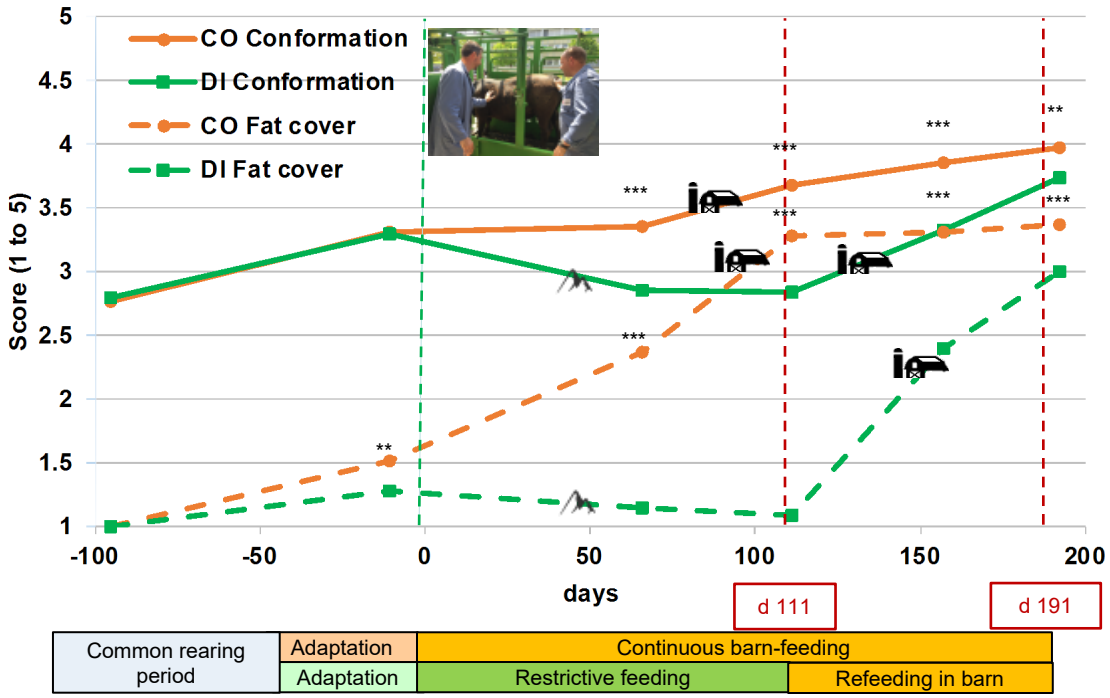
Protein in empty body (EB) in % of FM	d 111	Slaughter
CO	18.0 ± 1.0	16.6 ± 0.6
DI	19.5 ± 0.5	16.5 ± 0.7
P-value		
Treatment	***	ns
Crossbreed	**	*
	Li > Si > An	Li > An
Interaction T*C	0.17	0.44

(measured in additional heifers)

* *P*<0.05; ** *P*<0.01; *** *P*<0.001

Grading – CH-TAX

Evolution of grading scores according to CH-TAX (“conformation" and "fat cover") over time



	Score at slaughter (carcass)	
	Conformation	**Fat cover**
CO	4.36 ± 0.53	3.94 ± 0.61
DI	4.33 ± 0.48	3.73 ± 0.52
P-value	----------	----------
Treatment	ns	t (*P*=0.06)
Crossbreed	***	***
	Li > Si > An	An > Li > Si
Interaction T*C	0.75	0.40

* *P*<0.05; ** *P*<0.01; *** *P*<0.001

In summary

Compared with the continuously grown group,
the restriction of forage for more than 3.5 months and the fact that the heifers were kept on pasture rather than in the barn resulted in:
- growth rate ↘ (>50%)
- ↘ fat cover and conformation
- slower body development, except for height

The 85% grass-fed ration subsequently distributed in the cowshed induced compensatory growth of 43% in 80 days thanks to:
- ↗ feed intake
- ↗ feed conversion efficiency

After a further 80 days on the same ration to reach slaughter weight, the heifers fully compensated for the effects of the forage restriction with
- morphological characteristics,
- body composition,
- carcass value,
comparable to those of the continuously grown group, which reached final weight 35 days earlier.

Conclusion

Thanks to adaptive processes, growing heifers are able to cope with nutritional constraints along discontinuous growth itinerary and recover fully in terms of morphological development, body composition and carcass quality even at a moderate slaughter weight.

What about the compensatory growth consequences on:

- **(57.13) Feeding behaviour, methane emission and digestibility?**
- **(57.16) Metabolic and hormonal profiles?**
- **Meat quality?**

} *to see at* { Poster session 57 from August 30th afternoon

Thank you for your attention !

Thanks to
- Barn staff Agroscope
- Laboratory staff Agroscope