Soil intake in grazing sport horses

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Context

Ingestion of soil:

- the main way of exposure to environmental contaminants in free-range animals.
- whereas horsemeat hardly consumed (in France <0.3 kg.habitant^{-1} yearly)

In horses, the main concern is

- reduced welfare by pathologic risks (sandy or soiled stomach)
- possible deterioration of digestibility

but no data are available.

How many soil would be ingested by grazing horses ?

… in comparison to other grazing animals

Materials & Methods (1): the trial

<u>Aim</u>: study the soil intake in grazing horses depending on the herbage offer

Latin Square Design 3x3 carried out in East Limerick (Ireland) with 6 grazing sport horses:
Three levels of Daily Herbage Allowance **(DHA)**:

2, 3 or 4% of the BW (average 623 kg)

Each period: 10 d of adaption on the new plot + 6 d to carry out all the measurements.

Horses	Period 1	Period 2	Period 3
1 & 2	2%	3%	4%
3 & 4	4%	2%	3%
5 & 6	3%	4%	2%

The offered surface was estimated every 2 d measuring the herbage mass on the next surface to be grazed -> to reflect the three experimental DHA.

The allocated plots to each DHA were made using temporary electric fencing:

two horses were assigned during one period to a given treatment
moved every second day
with measurements of pre and post-grazing sward heights (**SH**).

Materials & Methods (2): soil intake estimation

Soil intake estimation by a marker method:
internal marker (acid insoluble ash **AIA**) & estimated digestibility of the total **DM** diet.

$$\textbf{Soil Intake (\% of ingested DM)} = \frac{AIA_{diet} + AIA_{feces} - (DM\ dig \times AIA_{feces})}{(DM\ dig \times AIA_{feces}) - AIA_{soil} + AIA_{diet}}$$

(Beyer et al., 1994)

Daily collection of Individual fecal samples from the center of the dung
(to avoid contamination by soil or dust !)

Soil and grass were sampled from each plot at each period.

AIA contents were analyzed in soil, feeds and feces (van Keulen & Young, 1977)

Materials & Methods (3): soil intake estimation

Daily intake of dry soil = **Daily DM intake** x **soil intake** (% of ingested DM)

$$\textbf{Daily grass DM intake} = \frac{\textbf{Daily output of fecal DM} \text{ (attributable to grass)}}{1 - \textbf{DM digestibility} \text{ of ingested grass}}$$

Daily output of fecal DM :

- Identification of individual feces by a color marker daily applied with 200 g of barley per horse
- Collect and weighing of daily output of fecal DM ; individual samples for DM and chemical analysis
- Correction using DM digestibility of barley *(0.81 ; INRA 2015)* to obtain faecal output attributable to grass

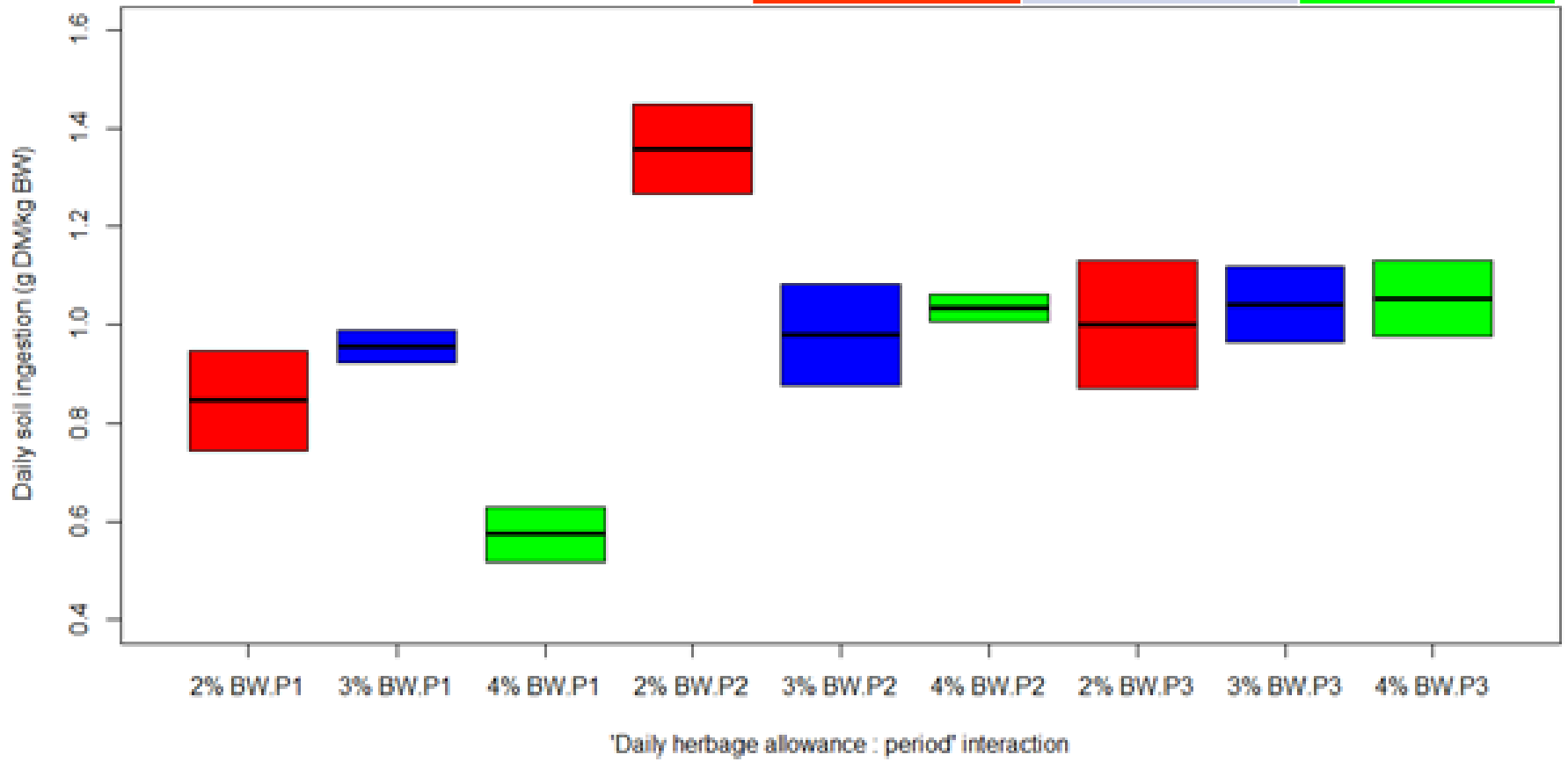
DM digestibility of ingested grass :

- Estimated *via* fecal CP content attributable to grass (according to *Mésochina et al. 1998)*
- Correction using CP content and apparent CP digestibility of barley *(INRA 2015) (Delagarde et al. 1999 ; Collas et al. 2015)*

Daily DM intake = **daily grass DM intake** + daily barley DM intake (=200 g x 0.87)

Results (1) : soil intake

Soil Intake	DHA 2%	DHA 3%	DHA 4%	*DHA effect (P –value)*
Proportion (% of diet DM)	4,53 a	4,09 ab	3,75 b	*< 0.05*
Amount absolute ($g.d^{-1}$)	648 a	624 ab	543 b	*< 0.05*
Amount relative ($g.kg^{-1}$ BW & d^{-1})	1.07	0.99	0.89	*Period * DHA*



Individual differences in behavior of animals when DHA decreases ?

Results (1): soil intake

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Proportion (% of diet DM)	4,53 a	4,09 ab	3,75 b	*< 0.05*
Amount absolute (g.d^{-1})	648 a	624 ab	543 b	*< 0.05*
Amount relative (g.100 kg^{-1} BW & d^{-1})	107	99	89	*Period * DHA*

Soil Intake

- increases when DHA decreases
- corresponds to herbivorous animals in sparse grazing conditions

Dairy cows in Britany (Jurjanz *et al.,* 2012)

- 20 - 30 g (100 kg BW & d) in good grazing conditions but 74 - 146 g when deteriorated

Growing bulls in Caribbean conditions (per 100 kg BW & d)

- 42 – 72 g for 2,8 to 8,4% DHA (Collas *et al.,* 2019)
- 72 - 104 g for 2 to 3,6% DHA (Jurjanz *et al.,* 2017)

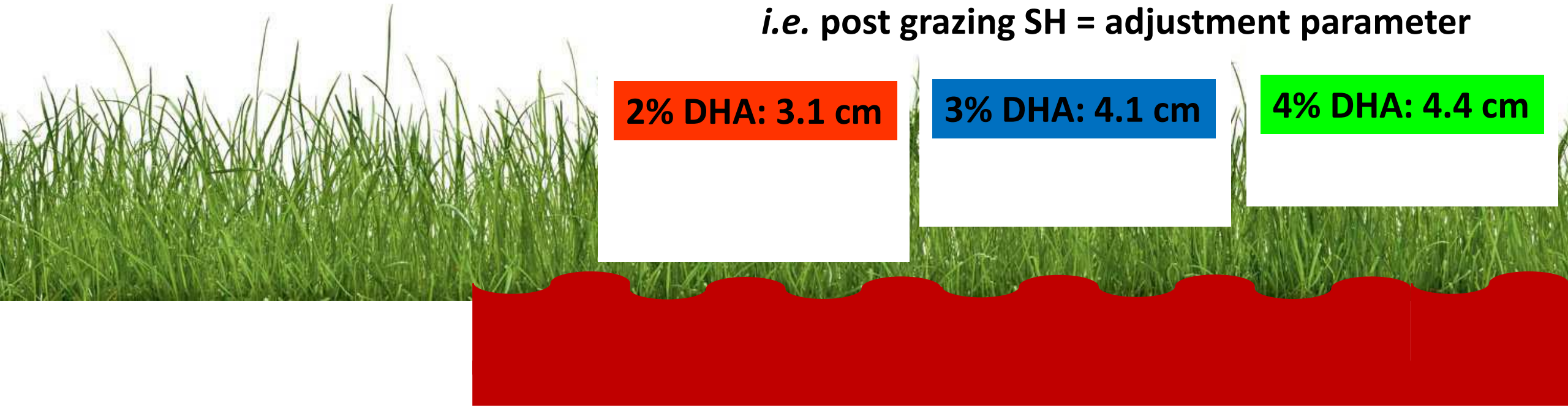
Results (2): sward heights

Similar Pre-grazing SH: 11.9 cm

but post-grazing SH varied significantly

average

***i.e.* post grazing SH = adjustment parameter**



explaining increased ingestion of soil

Conclusions

Horses can ingest up to 5% of soil when DHA is low, corresponding to > 0.5 kg of soil.d^{-1}

DHA is a central factor for the extent of soil intake, also in horses

The relationship to post grazing SH has be shown as in cattle and sheep

but the enhanced soil intake in horses seems lower than in ruminants.

Indeed, a sparse grass availability reflected by post-grazing SH <4 cm enhanced in ruminants soil intakes >10% what could be explained by different grass prehension between these species.

Perspectives

Need to **enlarge the approach** to other grazing conditions

- Humidity of grazed surface
- Different types of vegetation cover
- What happens if grazed surface is heterogeneous

Thank you for attention