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Ruminating and feeding behaviour in grazing dairy herds

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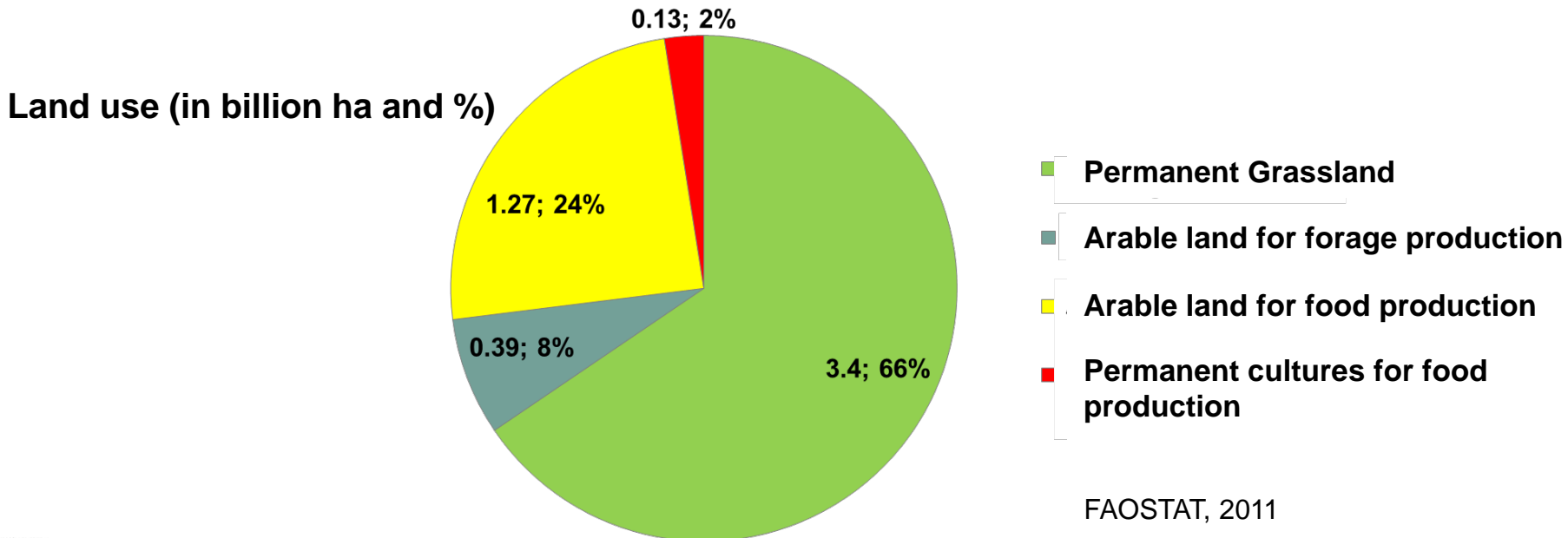
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Introduction / background: grassland utilisation

Grassland-based ruminant production:

› **A matter of global nutrient resource efficiency**

  › less feed-food competition for arable land

› **A matter of animal welfare**

  › better for species-specific ruminant physiology and -behaviour

› **At least grassland-rich regions are challenged to make better use of this resource (e.g. Switzerland)**

Land use (in billion ha and %)

0.13; 2%

1.27; 24%

0.39; 8%

3.4; 66%

- Permanent Grassland
- Arable land for forage production
- Arable land for food production
- Permanent cultures for food production

FAOSTAT, 2011

Introduction / background: concentrate reduction and pasture feeding: Swiss programs for direct payments

› **«Grassland-based milk and meat production»-program (GMF; since 2014)**

  › Min. 75% of ruminant feed must be produced on grassland

  › Participation: 70% of Swiss farms

› **Animal-welfare-outdoor-program («RAUS»; since 1993)**

  › Ruminants: min. 26 days / month on pasture during vegetation period

  › Participation: 80% of female cattle, 70% of Swiss dairy farms

› **Organic standards (BioSuisse)**

  › Ruminants: min. 90% roughage, min. 26 days / month on pasture during vegetation period, organic feed

Introduction: Roughage strategy is successful, but how to go on with breeding?

› **The Swiss "system-comparison-project" showed:**

  › economic, ecological, and animal health parameters are much better in low-input dairy systems (pasture feeding, very little concentrates) than in intensive systems (Gazzarin et al., 2011; Sutter, 2011)

› **But: are our breeding strategies adequate for pasture- and roughage based feeding systems?**

  › not only production- and health traits are important, but also efficiency on pasture / roughage

  › new traits showing animals' ability to adapt feeding and rumination behaviour to roughage quality and –structure have to be detected

› **Aim of the study**

  › observing individual eating and rumination behaviour of grazing dairy cattle on different farms

  › detecting factors influencing that behaviour

  › analysing relationships between behaviour and health factors

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Methods I

›	Feeding and rumination behaviour of 225 dairy cows on 8 low-input-farms were observed: 3 visits during vegetation period each for 3 days (72h), respectively

›	No interventions, just observation

›	BCS was estimated at each visit, body weight was measured twice

›	Pasture feed was estimated for growth stage at each visit

›	Data on daily milk production, milk composition, urea content, and somatic cell count were taken from the monthly milk recordings closest to the visits

›	Data on birth dates, calving dates, and lactation numbers, were provided by the breeding companies

Materials: RumiWatch® chewing sensors
Data converter 7.3.2. was used

Pressure tube, filled with oil

Sensors, data storage, transmission

Behaviour was not affected by wearing the nosebands (Animals with RumiWatch® nosebands on farm 5)

Methods II: Statistics

› General mixed effects models with repeated measurements were calculated with SPSS 20

› Only lactating cows with at least two observations were integrated (resulting in 137 remaining animals)

› Dependent variables:

  › rumination time/day, eating time/day, chews per rumination bolus, chews per minute during rumination

  › calving interval, Somatic Cell Score (SCS)

› Fixed effects:

  › lactation number, milk production, body weight, BCS, growth stage estimation of feed, behaviour variables, if not highly (r<0.6) correlated to each other

› Random effects:

  › Farm, animal (farm)

Results I: means of behaviours of each herd (descriptive)

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7	Farm 8
Eating time (min./day)	525 ± 56	449 ± 89	469 ± 89	461 ± 78	491 ± 92	522 ± 63	485 ± 77	554 ± 113
Rumination time (min./day)	495 ± 62	565 ± 64	559 ± 94	487 ± 67	446 ± 50	517 ± 73	609 ± 78	510 ± 51
Rumination speed (chews/min.)	53.4 ± 5.4	58.6 ± 5.0	59.9 ± 7.1	57.6 ± 5.4	49.5 ± 6.9	57.1 ± 5.6	61.4 ± 5.7	53.6 ± 6.0
Rumination intensity (chews/bolus)	39.7 ± 4.7	47.5 ± 5.2	44.1 ± 5.8	40.8 ± 5.8	40.7 ± 5.6	42.6 ± 5.7	48.6 ± 5.4	42.2 ± 6.5
Activity changes (no.)	4.8 ± 0.97	5.6 ± 1.6	5.5 ± 2.3	6.0 ± 0.8	5.2 ± 1.4	6.3 ± 2.4	5.3 ± 1.4	5.5 ± 2.3

lowest values   highest values

Results II: factors influencing behaviour

Dependent variable / Factor	Rumination time (min./day)		Eating time (min./day)		Rumination speed (chews/min.)		Rumination intensity (chews/bolus)	
	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
intercept	750.62	<0.001	940.7	<0.001	35.0	<0.001	35.36	<0.001
Pasture growth stage	21.37	<0.001	13.5	0.041	-0.118	0.738	0.185	0.676
Lactation number	-0.72	0.762	-4.6	0.048	-0.77	<0.001	-0.585	0.012
ECM (kg/day)	4.31	<0.001	-0.3	0.839	not in model		-0.144	0.048
Body weight (kg)	0.01	0.910	-0.275	<0.001	0.012	0.015	0.024	<0.001
Activity changes (no./day)	-15.60	<0.001	-15.5	<0.001	0.662	<0.001	-0.392	0.058
No. of Boli /day	not in model		not in model		0.046	<0.001	0.017	<0.001
Eating min./day	-0.48	<0.001	not in model		-0.023	<0.001	-0.019	<0.001
Rumination min./day	not in model		-0.541	<0.001	not in model		not in model	
Farm	2941.3	0.078	4039.5	0.084	13.89	<0.001	22.52	<0.001
Animal (farm)	1026.2	0.078	354.8	0.538	not in model		not in model	

Results III: effects of behaviour on fertility and udder health

Factor \ Dependent variable	Calving interval		SCS	
	Estimate	P-value	Estimate	P-value
Intercept	657.13	<0.001	0.851	0.696
Lactation number	-3.37	0.085	0.064	0.245
ECM (kg/day)	-0.158	0.842	-0.048	0.015
Body weight (kg)	0.03	0.658	0.006	0.001
BCSMin	-52.25	0.001	-1.147	0.005
Activity changes (no.)	2.03	0.390	not in model	
Eating time/day (min)	-1.69	0.006	0.002	0.158
Rumination time/day (min)	-0.049	0.628	0.001	0.416
Farm	49.04	0.639	0.091	0.457
Animal (farm)	not in model		0.708	0.005

Discussion / Conclusions I

Eating and rumination time of dairy cows are influenced by feed quality referred to as growth stage. In future studies it will be interesting to observe how fast and how well animals adapt to feed quality changes (on pasture). There might be interesting selection traits.

Discussion / Conclusions II

› Younger cows ruminate faster and with more chews/bolus than older cows. These aspects have been observed in several other studies.

› Animals with a higher milk production showed longer rumination times, but there was no effect on eating times. Actually, also longer eating times would have been expected. More observations are necessary.

› Animals with a high number of activity changes showed shorter rumination and eating times. This behaviour may be linked to positions in the herd hierarchy. More attention on that aspect should be given on dairy farms.

Discussion / Conclusions III

› Animals with low minimal BCS showed higher SCS and longer calving intervals. The reason might lie in phases of negative energy bilances and resulting metabolic disorders.

› Animals performing longer eating times/day showed shorter calving intervals. Those animals might have been able to well adapt their feeding behaviour to their current needs and therefore got less fertility problems.

› Further studies are needed on those subjects.

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The farmers for providing their animals and animal data

Thank you for your time and attention!
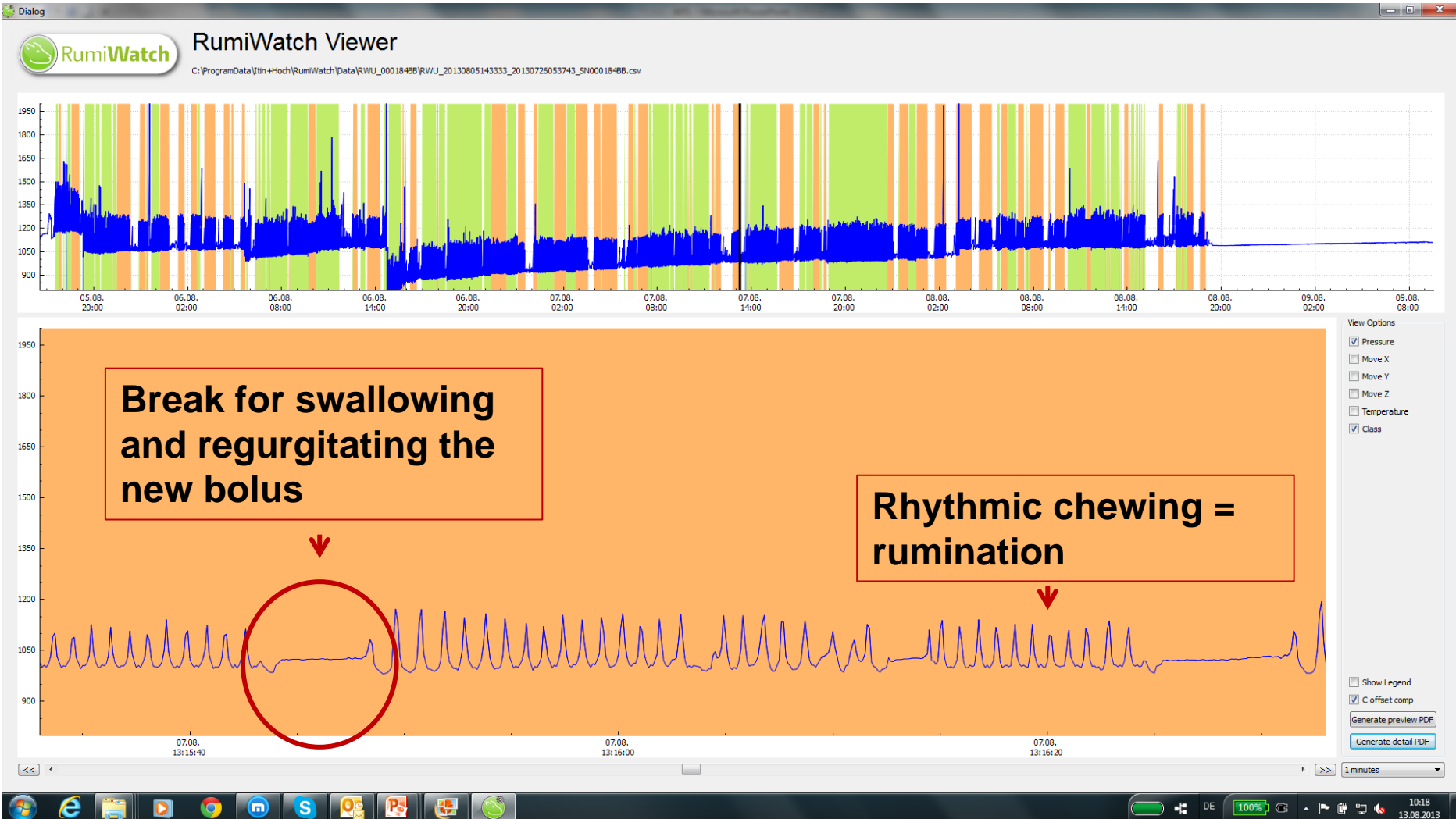
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Farms (descriptive)

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7	Farm 8
Breed	Swiss Fleckvieh	Deutsches Niederung srind	Swiss Fleckvieh	Swiss Fleckvieh	Simmen-tal	Swiss Fleckvieh	Swiss Fleckvieh	Simmen-tal
Nr of cows	49	50	24	13	40	16	57	14
Housing system	Loose housing, cubicles	Loose housing, cubicles	Loose housing, cubicles	Tie stall	Loose housing, cubicles	Tie stall	Loose housing, deep litter	Tie stall
Av. DMY kg/cow/day	18.5 ± 3.2	17.1 ± 2.9	21.3 ± 3.5	16.6 ± 2.6	19.5 ± 3.8	14.1 ± 3.1	16.5 ± 3.0	17.0 ± 2.7
Concen-trates (av. kg/cow/day	0	0	1	1	2	0	0	0
Av. Lact.Nr.	3.5 ± 2.4	3.0 ± 1.6	3.4 ± 1.9	4.0 ± 3.6	2.8 ± 2.0	3.5 ± 2.8	4.1 ± 3.0	4.7 ± 3.6
Mean CI (days)	377 ± 55.4	393 ± 54.9	373 ± 48.8	387 ± 67.1	381 ± 60.0	355 ± 23.6	385 ± 64.2	396 ± 35.0
Mean SCS	2.7 ± 1.3	3.8 ± 1.3	3.0 ± 2.1	2.6 ± 1.8	1.0 ± 0.9	2.1 ± 1.5	2.6 ± 1.2	2.0 ± 1.9
Time on pasture (spring)	Whole day	Not on pasture	½ day	½ day	½ day	Whole day	¼ day	Whole day
Time on pasture (summer)	¾ of the day	½ day	½ day	½ day	¾ of the day	Whole day	½ day	Whole day
Time on pasture (fall)	¾ of the day	½ day	¼ day	½ day	½ day	½ day	½ day	Whole day

Materials: RumiWatch® chewing sensors and converter 7.3.2.

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Less rhythmic chewing without any breaks = eating