

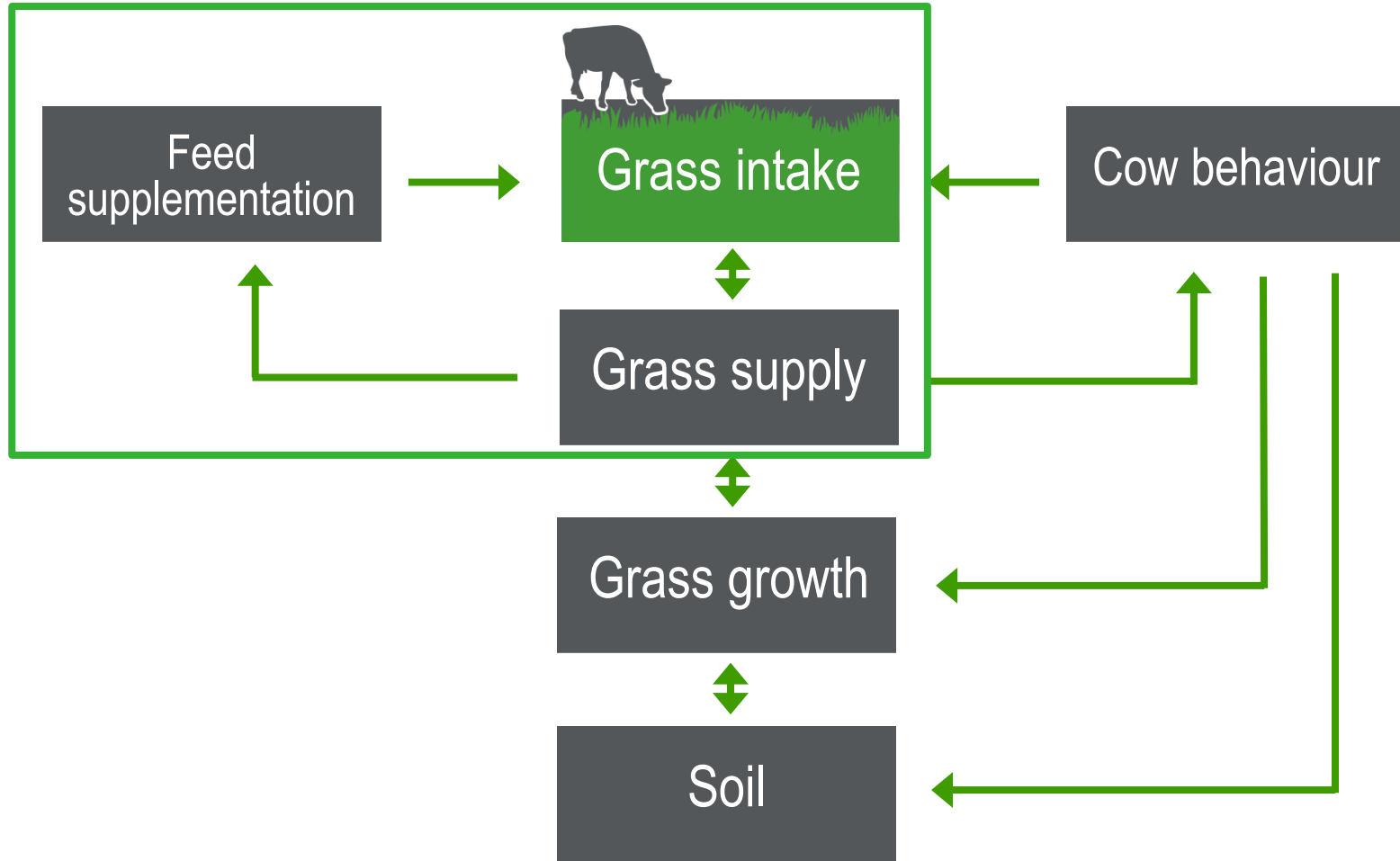
Nitrogen use efficiency (NUE_N) of dairy cows under intensive grazing

20 June, Cindy Klootwijk

*R.L.G. Zom, A. Van den Pol-Van Dasselaar, C.E. Van Middelaar,
G. Holshof and I.J.M. De Boer*



Components of Amazing Grazing



Challenges intensive grazing vs NUE_N

- Dutch dairy sector
 - > cows per grazing area
 - High demand for grazing
 - Focus on improving NUE_N

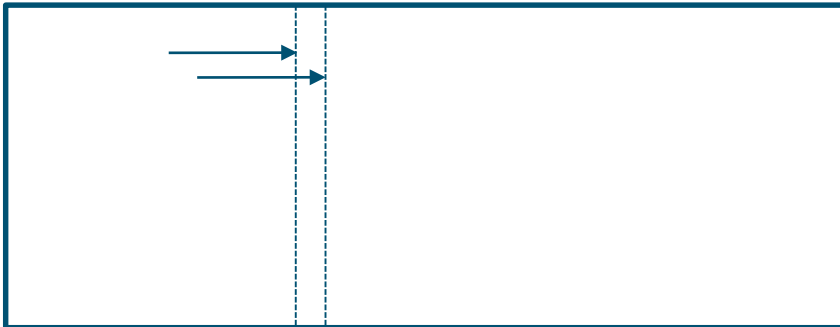


- Limited knowledge on grass (N) intake
- High level of feed supplementation

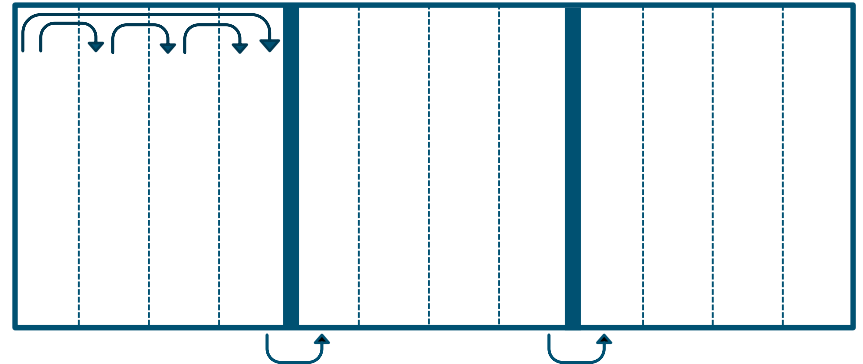
Grazing systems for intensive grazing

- Higher grassland utilization
- More equal distribution of manure

Stripgrazing (SG)



Compartmented continuous grazing (CCG)



Protein level supplementation

Grass intake?

$NUE_N?$

Objective:

To test the effects of intensive grazing systems and dietary protein level on NUE_N at cow level

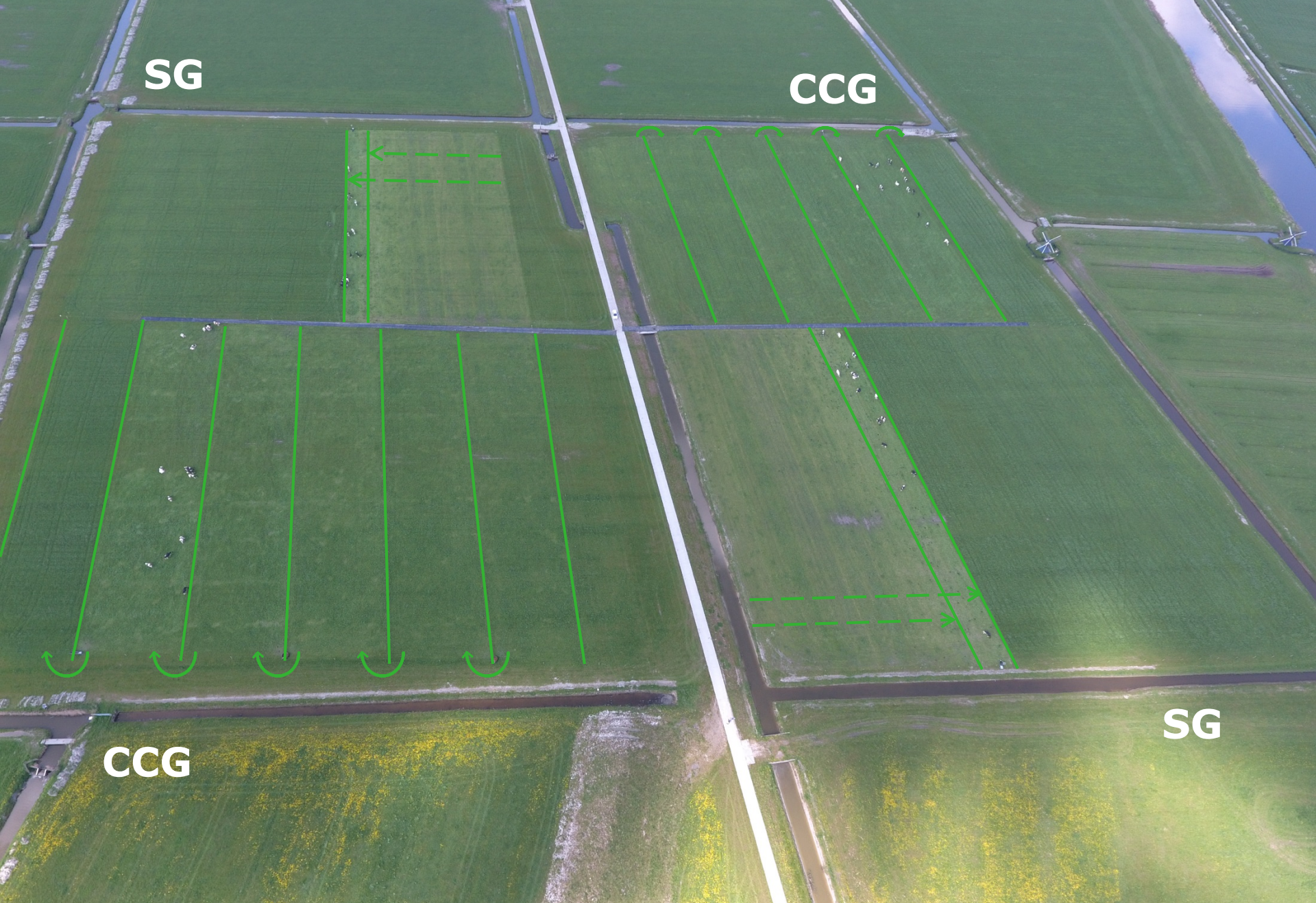
2 x 2 factorial design

Grazing system	Protein level	
	SG Low RDP	SG high RDP
CCG Low RDP	CCG High RDP	

- RDP = rumen degradable protein
 - Contrast of 500 g RDP cow⁻¹ day⁻¹

5 kg concentrates with sugar beet pulp (-50) or rapeseed meal (+50)

Dairy Campus, Leeuwarden (NL)



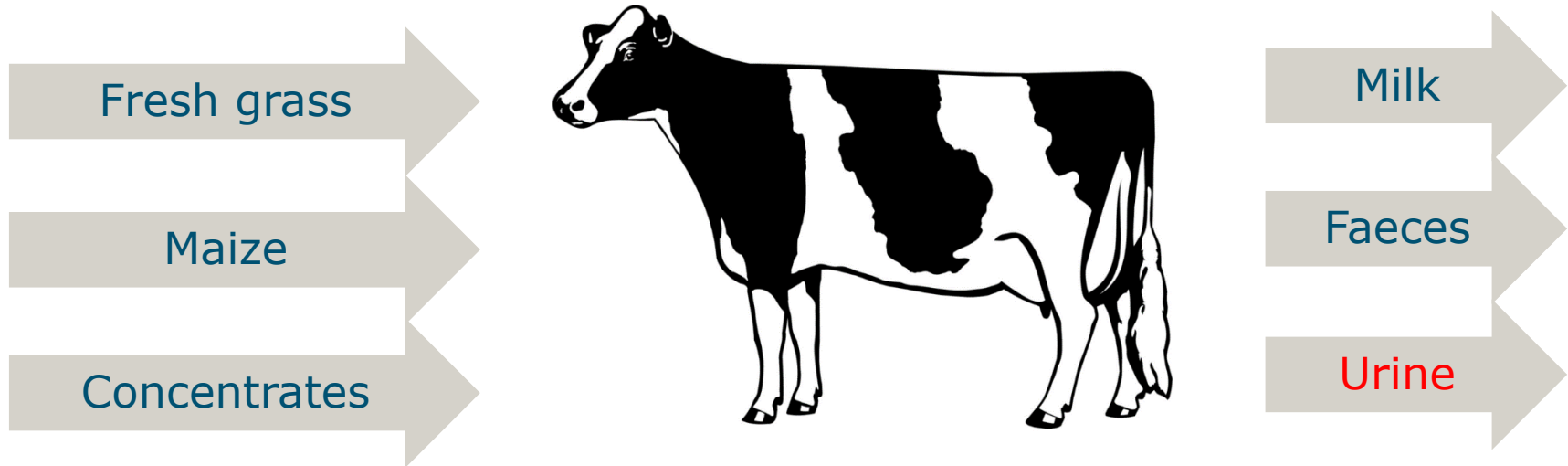
2 x 2 factorial design

- April – October 2016 + 2017
- 8 ha: 7.5 cow per ha
- Daytime grazing



- 4 groups of 15 dairy cows (HF)
 - Before start: 38.8 kg FPCM cow⁻¹ day⁻¹
 - At start: 175 (115-247) days in lactation
 - 2.6 (1-7) lactations

Quantifying inputs and outputs



$$\text{NUE}_N = \text{N milk} / \text{N feed}$$

$$\text{N digestibility} = (\text{N feed} - \text{N faeces}) / \text{N feed}$$

- 60 individual dairy cows
- Subset: July + September 2016

Quantifying inputs and outputs

Fresh grass

Marker technique: n-alkane
(Mayes et al., 1986)

Faeces

Automated registration

Maize



Concentrates



Milk

Quantifying inputs and outputs

- Grass samples: daily at 09:00
- Manure samples: twice a day after milking
- Milk samples: 4 consecutive milkings



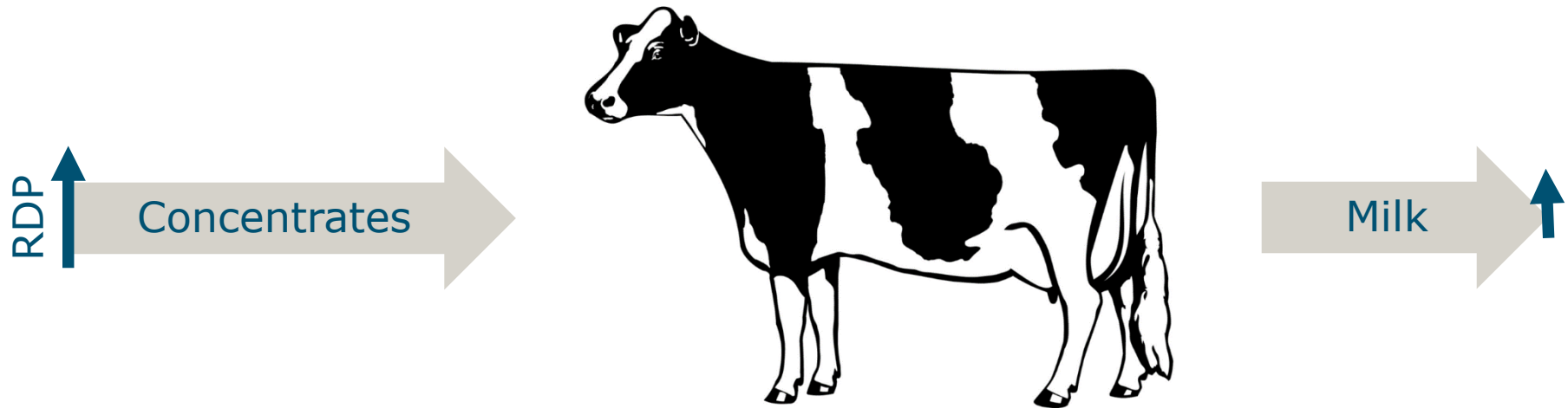
Results NUE_N : SG vs CCG

SG: 4.2 kg DM cow⁻¹ day⁻¹
CCG: 3.6 kg DM cow⁻¹ day⁻¹



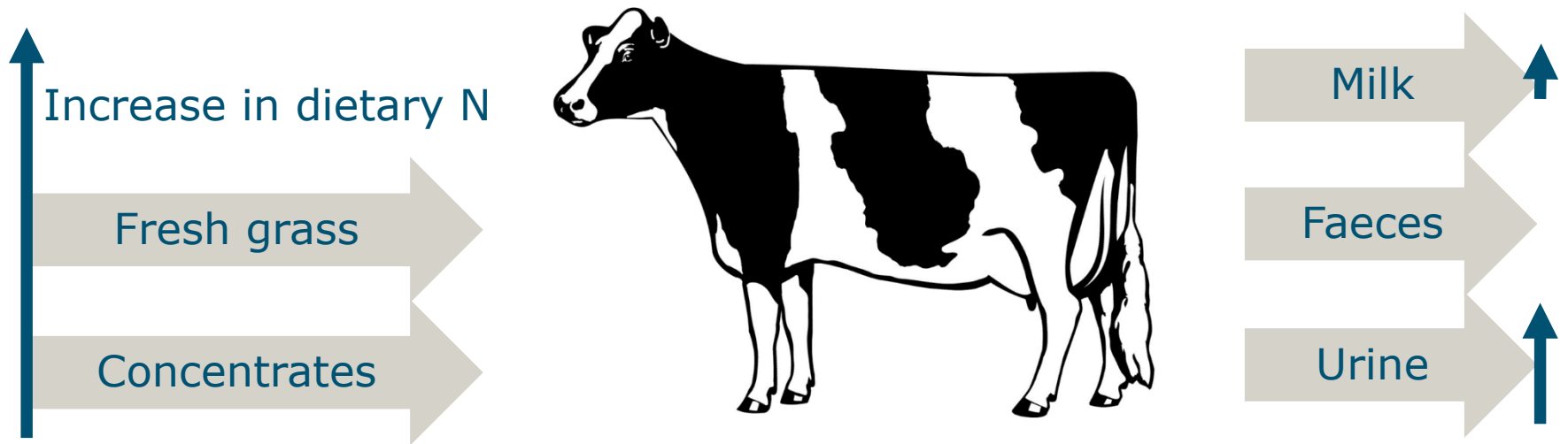
- July: SG < CCG (37% vs 39%; $P=0.003$)
 - due to higher grass (N) intake
- Sept.: No difference SG and CCG ($P=0.723$)
 - due to lower grass RDP content

Results NUE_N : high vs low RDP



- High RDP < low RDP (35% vs 41%; $P < 0.001$)
 - due to higher concentrate N intake
 - despite higher milk output: 30 vs 26 kg cow⁻¹ day⁻¹

Results N digestibility



Low N digestibility

- Absolute RDP levels
 - Low RDP was very low (-300)
 - High RDP was 'normal' (+200)
 - Shortage N on rumen level
 - Low NH_3 in rumen: <3 mmol/L
 - Low milk urea: 10 mg/dl
- N digestibility grass?



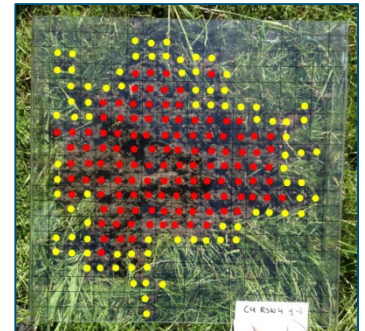
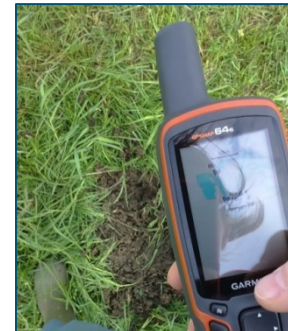
Conclusions

- SG slightly higher grass intake compared to CCG
 - Grass N digestibility?
- Increase in feed N
 - Increase in urine N
 - Increase in N digestibility
 - Decrease in NUE_N
- High faeces N; low urine N → environmental impact

To be continued..

■ Further analyses

- Tested with higher N level in 2017
- NUE_N at farm level



Amazing Grazing!!!

Amazing Grazing is funded by:



Duurzame Zuivelketen is gezamenlijk initiatief van:



nederlandse zuivel organisatie

Partners in Amazing Grazing:



Amazing Grazing is realised in cooperation with:

provinsje fryslân
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N inputs / outputs / efficiency parameters

	Treatment groups					GS	RDP	GS*RDP
	P	CCG-H	CCG-L	SG-H	SG-L	P	P	P
Total feed in kg DM cow⁻¹ day⁻¹	J	19.3	18.3	18.8	18.1	0.249	0.01	0.678
	S	18.9	18.0	18.9	17.5	0.579	0.006	0.518
Total feed N in g cow⁻¹ day⁻¹	J	472	354	480	375	0.071	<0.001	0.424
	S	447	360	454	351	0.924	<0.001	0.419
Grass in kg DM cow⁻¹ day⁻¹	J	4.1	4.2	4.6	4.9	0.014	0.477	0.559
	S	2.8	3.4	3.6	3.8	0.033	0.159	0.547
Grass N in g cow⁻¹ day⁻¹	J	140	132	161	166	0.002	0.881	0.44
	S	113	139	128	141	0.395	0.058	0.502
Milk in kg cow⁻¹ day⁻¹	J	30.8	25.8	31.0	25.9	0.834	<0.001	0.937
	S	28.9	25.2	29.4	25.5	0.619	<0.001	0.903
Milk N in g cow⁻¹ day⁻¹	J	170	148	166	144	0.255	<0.001	0.986
	S	150	144	153	142	0.921	0.081	0.618
Faecal N in g cow⁻¹ day⁻¹	J	162	152	146	140	<0.001	0.023	0.481
	S	136	148	146	131	0.67	0.811	0.054
Urine N in g cow⁻¹ day⁻¹	J	140	54	168	91	<0.001	<0.001	0.541
	S	159	68	155	78	0.758	<0.001	0.484
NUE_N in %	J	36	42	34	39	0.003	<0.001	0.24
	S	34	40	34	41	0.723	<0.001	0.817
N digestibility⁶ in %	J	66	57	70	63	<0.001	<0.001	0.281
	S	69	58	68	63	0.463	<0.001	0.179

Compared to an efficient Dutch cow

Jan Dijkstra, 2013

	Efficient cow	Low RDP	High RDP
N feed	461	360	463
N faeces	89	143	148
N urine	174	73	156
N milk	198	144	159
NUE_N %	43	40	34
N digestibility %	81	61	68

- High average NUE_N: 37%
 - Low N feed input
- Low average digestibility: 64%
 - High N faeces
 - Low N urine