Ariette van Knegsel
is a researcher at the Adaptation Physiology Group at Wageningen University. She finished her Master Animal Science at Wageningen University with distinction in 2002. She worked as a junior researcher at the Institute for Pig Genetics (Beuningen, NL). She started her PhD at the Animal Nutrition Group and Adaptation Physiology Group of Wageningen University in 2003. Topic of her PhD was 'Energy partitioning of dairy cows'. From 2007 till 2010 she worked as a postdoc and wrote grant proposals in the area of energy metabolism and nutrition in livestock species. Since March 2010 she is project leader of WHYDRY, which aims at evaluating dry period length from cow health's perspective. Since July 2013 she is project leader of 'Customised Dry Period', which aims at optimizing a differentiated dry period strategy to improve health and welfare of dairy cows and maintaining milk quality. Her current work focuses on the physiology and management of dairy cows during the transition period and beyond. She is daily supervisor of 5 PhD students on topics related to energy metabolism, immunology, lactation persistency, biomarkers and behaviour of dairy cows and calves.

Ariëtte van Knegsel – Customising dry period length to improve adaptation to lactation

Customising dry period length to improve adaptation to lactation

22 October 2015

Ariëtte van Knegsel, Novi Mayasari, Juncai Chen, Akke Kok, Renny van Hoeij and Bas Kemp

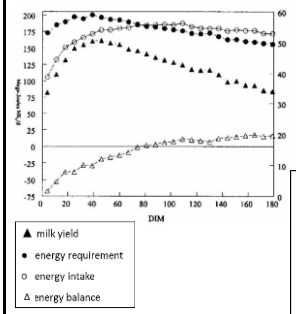
Adaptation Physiology Group, Wageningen University

This presentation

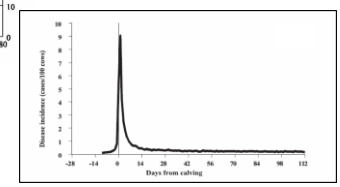
- Function of the dry period
- WHYDRY project: effect of dry period length on the energy balance and health of dairy cows (2010-2014)
- Current work: Customised Dry Period (2013-3017)

Why a dry period?

Why 'WHY DRY'?



The early lactation period is characterized by a negative energy balance and a high disease incidence.



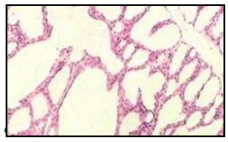
(De Vries and Veerkamp, 1999, Friggens et al., 2004)

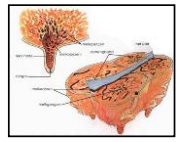
Why a dry period?

Advice to farmers: dry period of 6 till 8 weeks...
.... to maximize milk yield in the next lactation.

Function of the dry period for dairy cows:

- renewal of mammary secretory cell population (Capuco et al., 1997)
- period to treat cows with (preventive) antibiotics (Neave et al., 1966)
- (previously also: restoring body reserves)





Shorter dry periods cost milk

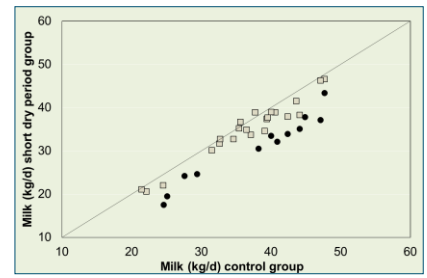


Fig. 3. Effect of a shortened (28-35 days) (□) or no dry period (●) compared with a conventional dry period (56-63 days) for dairy cows on milk production (Van Knegsel et al., 2013).

Based on: Andersen et al., 2005; Annen et al., 2004; Bachman, 2002; Coppock et al., 1974; de Feu et al., 2009; Fernandez et al., 2004; Gulay et al., 2003; Jolicoeur et al., 2010; Klusmeyer et al., 2009; Lotan and Adler, 1976; Pezeshki et al., 2008; Pezeshki et al., 2007; Rastani et al., 2005; Remond et al., 1992; Remond et al., 1997; Santschi et al., 2011a; Schlamberger et al., 2010; Soleimani et al., 2010; Sorensen and Enevoldson, 1991; Swanson, 1965; Watters et al., 2008.

Ariëtte van Knegsel – Customising dry period length to improve adaptation to lactation

Can shorter dry periods improve cow health?

Short, or no, dry period:

- improved the energy balance in early lactation (Rastani et al., 2005)
- reduced ketosis incidence (Watters et al., 2008; Santschi et al., 2011)

..., but also:

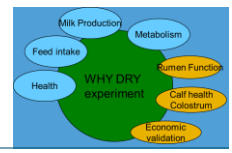
- increases somatic cell count (Annen et al., 2004; Klusmeyer et al., 2009)
- has variable effects on mastitis incidence (Church et al., 2008; Pezeshki et al., 2008).
- limited knowledge on fertility, persistency, calf health, successive lactations,..
- consequences for nutritional and insemination strategies?

WHYDRY - effect of dry period length on the energy balance and health of dairy cows

Objective and approach 'WHY DRY'

To determine the value of shortening the dry period to improve adaptation of dairy cows to (a new) lactation, eliminate NEB-associated disorders and thereby simplify cow management.

Special focus on:
- Long-term effects
- Persistency
- Calf health



Approach:

1. Animal experiment including cows for 2 lactations
2. Separate experiment on rumen function
3. Network of dairy farmers.

Experimental design 'WHY DRY'

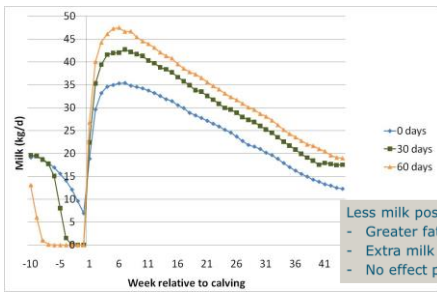
- 168 cows (all parities)
- 3 dry period lengths: 0, 30, and 60 days
- 2 diets in early lactation:
  - lipogenic and glucogenic
- 2 lactations
- Experimental period:

'dry period – lactation – dry period – lactation'

Complete **report** (Dutch) and **publications** (English) available on: www.adp.wur.nl

Results: No dry period costs milk

Fig 4. Milk production for cows with conventional (60d), short (30d) or no dry period (N=167).



Less milk postcalving, but:
- Greater fat and protein %
- Extra milk precalving
- No effect persistency?

Dry period length: $P<0.01$
Diet: $P=0.59$

Difference between young and old cows

Table 1. Milk production (FPCM; kg) whole lactation, **young and old cows**,

	Dry period length		
	0 days	30 days	60 days
Total milk production, ***parity 2***			
week: -8 till 0	1081	447	0
week: 0 till 44	8083	10451	11110
Total: week -8 till 44	**9164**	**10898**	**11110**
Total milk production, ***parity > 2***			
week: -8 till 0	797	442	0
week: 0 till 44	8804	9883	10775
Total: week -8 till 44	**9601**	**10325**	**10775**

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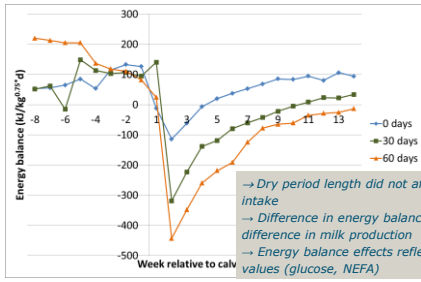
Short or no dry period results in better energy balance

Fig 5a. Energy balance for cows with conventional (60d), short (30d) or no dry period (N=167)

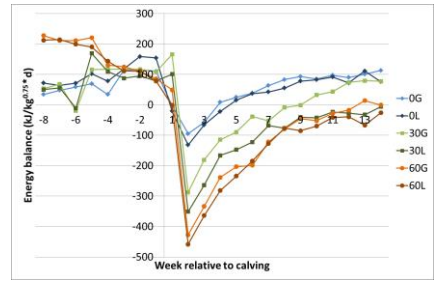


→ *Dry period length did not affect dry matter intake*
→ *Difference in energy balance due to difference in milk production*
→ *Energy balance effects reflected in plasma values (glucose, NEFA)*

Post calving: Dry period: *P*<0.01;
Diet: *P*=0.02 (Van Knegsel et al., 2014)

Effects of dry period length and diet are additive

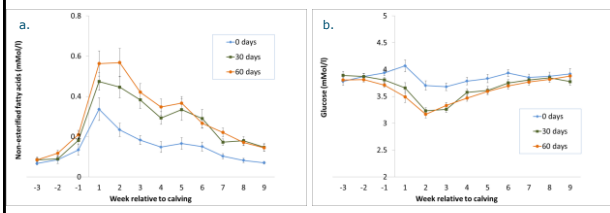
Fig 5b. Energy balance for cows with conventional (60d), short (30d) or no dry period and fed either a glucogenic (G) or lipogenic (L) diet in early lactation(N=167).



Post calving: Dry period: *P*<0.01;
Diet: *P*=0.02 (Van Knegsel et al., 2014)

Energy balance effects reflected in plasma values

Fig 6. Plasma **NEFA** (a) and **glucose** (b) concentration for cows with conventional (60d), short (30d) or no dry period (N=92).



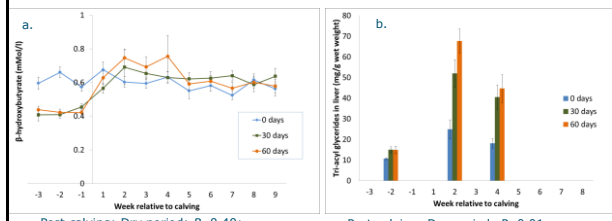
Post calving: Dry period: *P*<0.01;
Diet: *P*=0.48

Post calving: Dry period: *P*<0.01;
Diet: *P*=0.82

(Chen et al., 2015a)

Cow metabolism

Fig 7. Plasma **BHBA** (a) and liver **TAG** (b) concentration for cows with conventional (60d), short (30d) or no dry period (N=92).

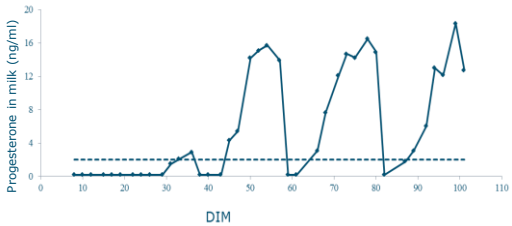


Post calving: Dry period: *P*=0.40;
Diet: *P*=0.02

Post calving: Dry period: *P*<0.01;
Diet: *P*=0.58

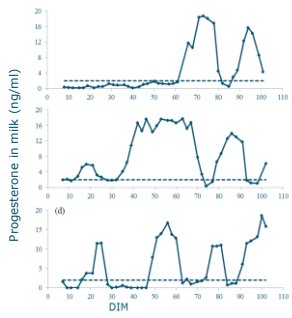
(Chen et al., 2015a)

Normal resumption of ovarian cyclicity



(Pushpakumara et al., 2003; Chen et al., 2015b)

Abnormal resumption of ovarian cyclicity



(Pushpakumara et al., 2003; Chen et al., 2015b)

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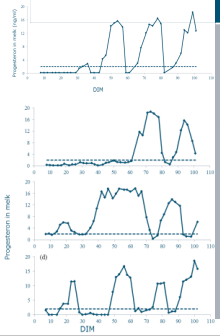
0 days dry:

→ ovulate earlier post calving

→ had more regular cycles

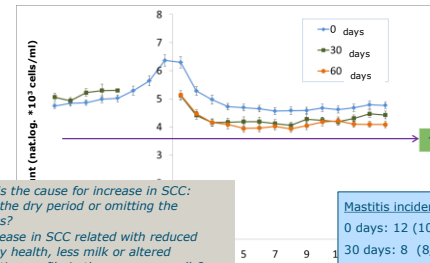
(Chen et al., 2015b)



Variable	Dry period length		
	0 days	30 days	60 days
Normal resumption of ovarian cyclicity (%)	53.2 (25/47)[a]	47.7 (21/44)[ab]	26.0 (13/50)[b]
Abnormal resumption of ovarian cyclicity:			
Type I: late ovulation or anovulation (%)	2.1 (1/47)	18.2 (8/44)	16.0 (8/50)
Type II: long luteal phase (%)	44.7 (21/47)	34.1 (15/44)	50.0 (25/50)
Type III: cessation of cyclicity (%)	0.0 (0/47)	0.0 (0/44)	8.0 (4/50)

No dry period increases somatic cell count

Fig 11. Somatic cell count in milk of cows with conventional (60 d), short (30 d) or no dry period (N=167).

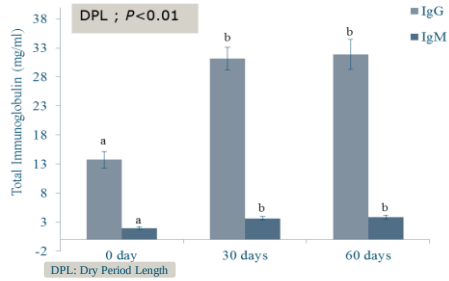


→ What is the cause for increase in SCC: omitting the dry period or omitting the antibiotics?
→ Is increase in SCC related with reduced mammary health, less milk or altered regeneration profile in the mammary cells?

Mastitis incidence, week 0-14:
0 days: 12 (10/56 cows);
30 days: 8 (8/55 cows);
60 days: 10 (9/56 cows)

Post calving: Dry period length: *P*<0.01;
Ration: *P*=0.95

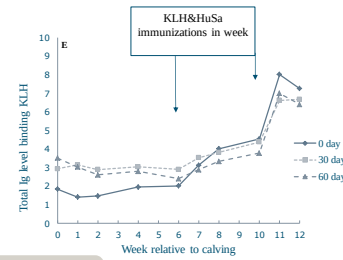
Lower IgG in colostrum



(Mayasari et al., 2015)

Lower plasma antibodies in first weeks, later no effect

- Calves received colostrum of their own mother (2 x 2 ltr in first 24 hrs);
- Calves were immunized with model antigens (KLH and Husa) in week 6 and 10
- No effect on calf growth first 12 weeks

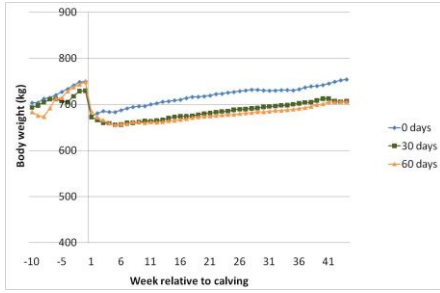


KLH : Keyhole Limpet Hemocyanin
HuSA: Human Serum Albumin
DPL: Dry Period Length

(Mayasari et al., 2015)

Cows get fat during next lactation

Fig 14. Body weight for cows with conventional (60d), short (30d) or no dry period (N=167)



Dry period length: *P*<0.01
Diet: *P* =0.58

Second lactation within WHYDRY experiment

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Second lactation:

Differences between dry period lengths much smaller → milk
→ SCC
→ EB

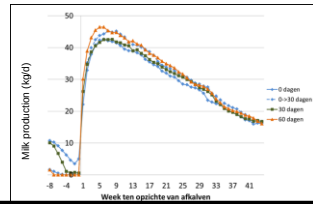
But:

Part of the cows with no dry period got **fat** and were not **persistent** enough for 2 lactations without a dry period.

→ **Glucogenic diet** was much more beneficial for EB and health!

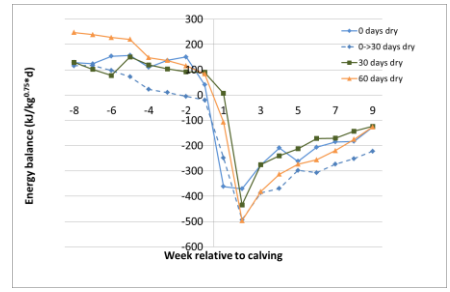
Milk yield in the second lactation after a dry period of 0, 30 or 60 days.

Cows in the '0→30 group' dried themselves off.



Second lactation: Differences in EB much smaller

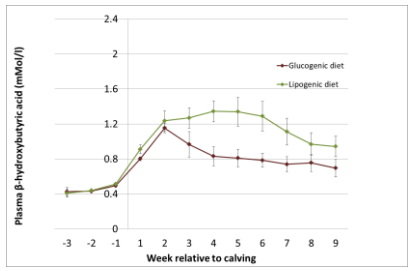
Fig 16. Energy balance for cows with conventional (60d), short (30d) or no dry period (0d). (N.B. Cows in the 0->30 days dry group were planned for 0 d dry period, but dried themselves off)



Dry period length: $P<0,01$
Ration: $P = 0.84$

- Effects of dry period on metabolic health smaller
- Effects of diet in early lactation larger

Fig 17. Plasma β-Hydroxybutyric acid for cows fed a glucogenic or lipogenic diet (N=130)



Dry period length : $P=0.05$
Ration: $P < 0.01$

Conclusions WHYDRY

Short dry period

- Limited reduction in milk yield
- Improvement of the energy balance
- No effect on: SCC, colostrum, calves
- Shortening the DP for 2 subsequent lactations is possible!

No dry period

- Strong reduction in milk yield
- Large improvement of the energy balance and metabolic health
- Greater SCC, lower colostrum quality
- Risk that cows are not persistent enough
- Option for selected group of cows.

Customised dry period

WHYDRY results in new questions...

- How does dry period length interact with ***antibiotic use and mammary health*** during the dry period?
- How to adjust the ***ration composition*** of dairy cows with no dry period?
  - Limit overfattening
  - Stimulate persistency of cows with short/no dry period
- Is the optimal dry period length depended on ***individual cows*** (parity, genotype,...) ?
- What are the consequences for ***net herd results, environment and welfare of animals?***

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Objective 'Customised Dry Period'

To optimize a differentiated dry period strategy and to transform it into an application for the Dutch dairy chain by an individual cow approach

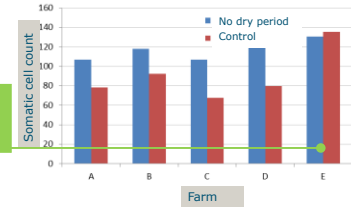
- Ration composition & Use of antibiotics
- Evaluate consequences for animal - (welfare), herd - (economics) and chain (environment).

Antibiotic use

In WHYDRY: effect of **dry period length** was confounded with effect of **antibiotic use** at drying off.

NETWORK FARMS WITH NO DRY PERIOD

Farm E: *Control* vs. *No dry period* both with no antibiotic use at drying off.



What is the interaction between **antibiotic use**, **dry period length** on mammary health?

Net herd results

Milk revenues and estimated feed costs per cow per lactation of 305 days in the WHYDRY experiment.

	Dry period length			
	0 d	0→30 d	d	60 d
First lactation				
Milk yield (in euro's, FCDF)	4214	4141	4220	4254
Estimated feed costs (Kuttem et al., 2014)	1087	1071	1094	1113
Milk yield – feed costs	3126	3069	3126	3141

But:
→ How to estimate the economic consequences of effects on EB or animal health?
→ Are feed costs depended on dry period length?
→ Is it correct to compare cows based on 305 day-yields?

Comparing milk yield

Traditional: **305-d yield** does not account for:

305 DIM

→ **Effective lactation yield**:
- Measure for milk yield corrected for differences in dry period length and intercalving interval
- 60d before calving to 60d before calving

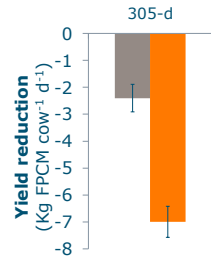
(Kok et al., 2015)

Methods – Yield measures

- 305-d yield
- 365-d yield
  - 305-d yield + 60-d additional yield
- Effective lactation yield
  - 60d before calving until 60d before calving
  - shifted lactation yield
  - variable duration

35

Results – Standard vs. short/ no dry period



Additional Yie

Dry Period
Short
No

Reduction in calving interval

Dry period	days
Short	18
No	25

36

Ariëtte van Knegsel – Customising dry period length to improve adaptation to lactation

Customised dry period - *What's next?*

- Ration optimalisation for cows with a short (no) dry period
- Antibiotic use and dry period length
- Individual cow approach
- Evaluation long-term consequences (network farms)
- Evaluation environment, economics and animal welfare

→ Development of a decision-support-tool based on individual *individual cow characteristics* (e.g. parity, genotype, BCS, persistency, intercalving interval,...).

WAGENINGEN UR
For quality of life

Take-home

No dry period:

- significant effects on EB and milk yield
- option for selected group of cows

Short dry period (30d):

- beneficial for EB, limited (no?) reduction in milk yield
- fits large group of cows

Customised dry period

- Optimal dry period length depended on individual cow characteristics (parity, persistency, genotype...)?

WHYDRY

Financers
Productschap Zuivel
Productschap Diervoeder
CRV

Steering committee WHYDRY
Dirk-Siert Schoonman/Toon van Hoof
Willem Koops
Machiel Blok/Willem Swinkels
Erwin Koenen

Working committee WHYDRY
Jeanet Brandsma/Janet Bakker
Jacob Goelema
Eddy Weurding
Harmen van Laar
Hiemke Knijn
Ruurd Jorritsma

Network Dairy Farmers

Researchers
Gerrit Remmelink
Roselinde Goselink
Saskia van der Drift
Henk Hogeveen
Wilma Steeneveld
Marleen Visker
Rupert Bruckmaier
Anette van Dorland
Craig Baumrucker
Josef Gross
Kasper Hettinga
Toon van Hooijdonk
Lu Jing
Elsa Fernandez
Ruben de Vries
Veerle Fievez
Sasitorn Jorjong

Ariette van Knegsel
Juncai Chen
Novi Mayasari
Nicoline Soede
Henk Parmentier
Ger de Vries-Reilingh
Iris van Noort
Kristina Simon
Bas Kemp

Dairy Campus Farm
Martin de Bree
Edwin Bleumer
Karel van Houwelingen
Jan Zandbergen
Jan van Dieren
Gerard de Bree

MSc Students
Carlijn-Bas-Renske-Wilke-Anieke-Eline-Johan-Nina-Martine

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Customised dry period

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Steering committee
Willem Koops
Henry Voogd
Hanneke van Wichen
Margo Meijerink
Jacob Goelema

Network Dairy Farmers

Dairy Campus Farm
Martin de Bree
Edwin Bleumer
Karel van Houwelingen
Jan Zandbergen

Researchers
Gerrit Remmelink
Henk Hogeveen
Imke de Boer
Corina van Middelaar
Jan Dijkstra
Theo Lam
Gert van Duinkerken
Rupert Bruckmaier
Josef Gross
Rudi Koopmanschap
Ger de Vries-Reilingh
Renny van Hoeij
Akke Kok
Wei Xu
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