Challenges and new developments in dairy cattle nutrition

August 29th, 2016. Annual meeting EAAP, Belfast (UK)

Gert van Duinkerken & Roselinde Goselink

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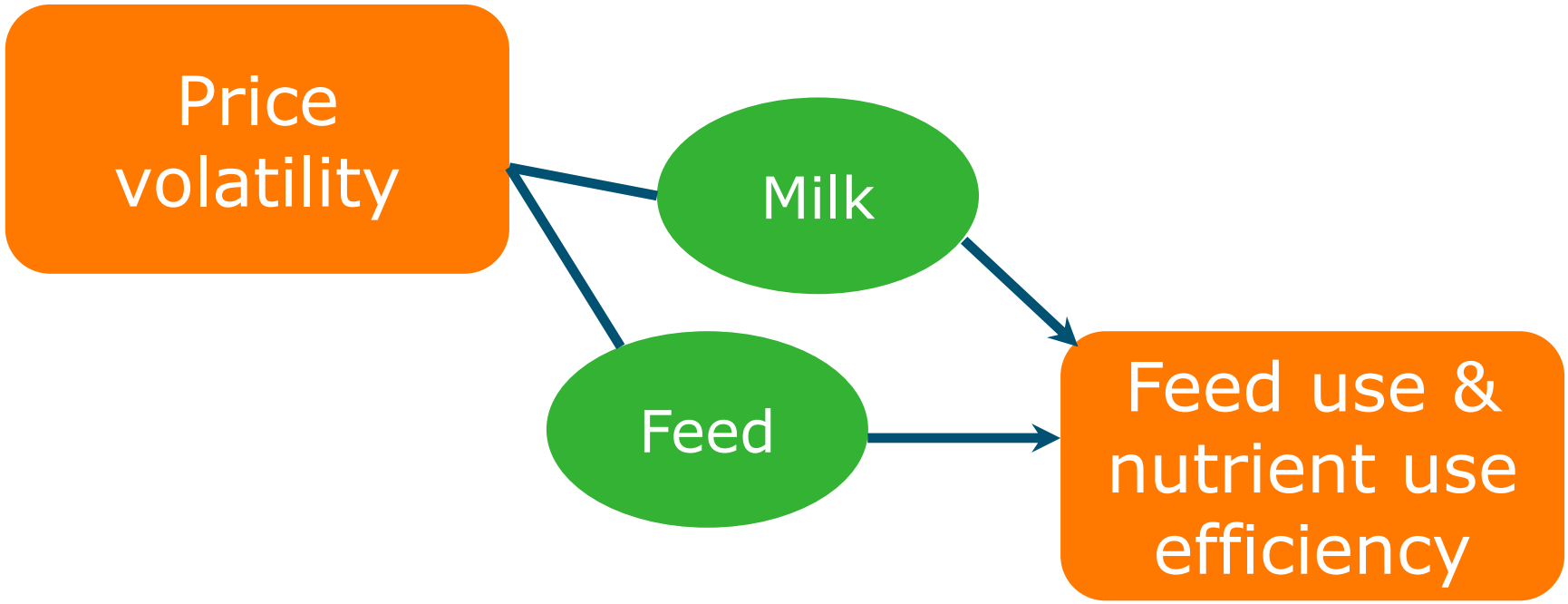
NO MILK QUOTA

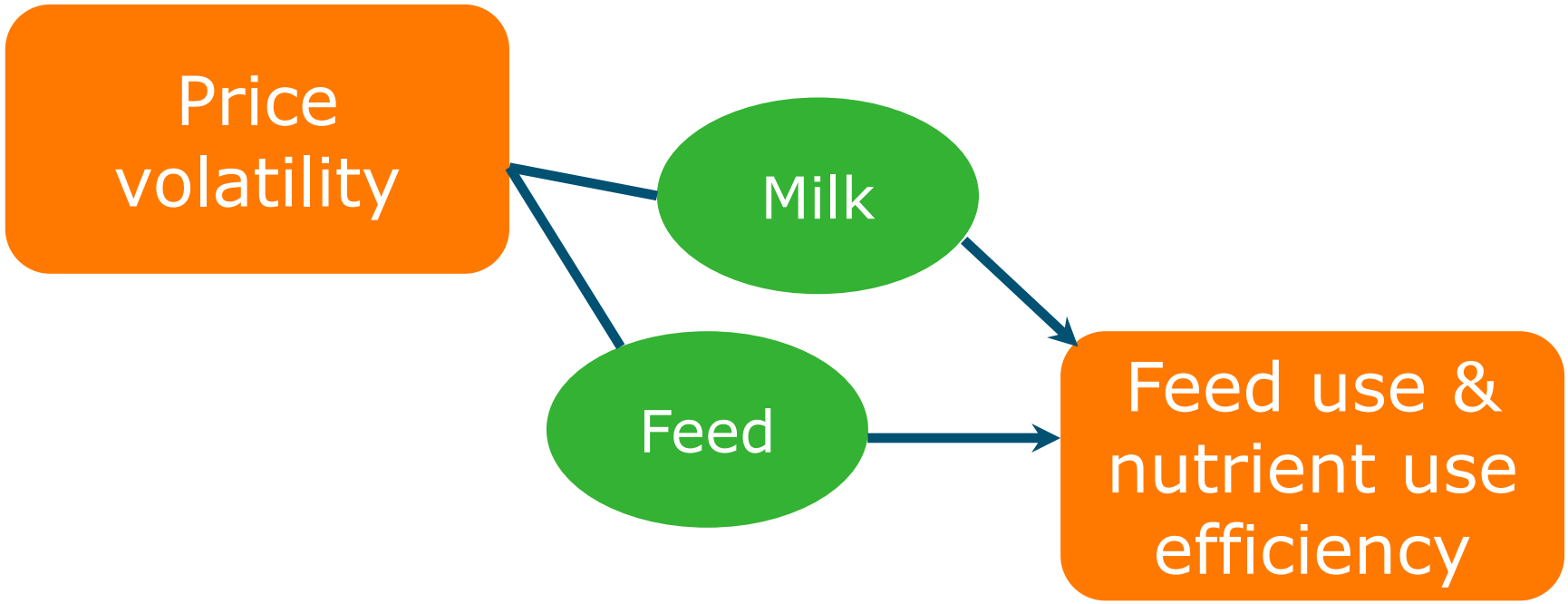
The post quota scene (I)

- Global dairy production
  - Global dairy production will grow about 2% per year (FAO, OECD)
  - Majority of extra production will come from developing countries
- Farm profitability highly dependent of
  - Input prices (e.g. feed)
  - Output prices (milk)
  - To a lesser extent: farm scale
- Milk prices will be volatile
  - Mean milk price level will slightly decrease, compared to quota era
- Feed prices will be volatile
  - Mean feed price will increase

Price volatility



Price volatility



Trend 1: Precision Livestock Feeding

The post quota scene (II)

- Dairy production limited by scarce resources, e.g.
  - Water; arable land in developing countries; know-how

- Growing dairy production

  → Increasing feed demands

  → increasing feed protein demands

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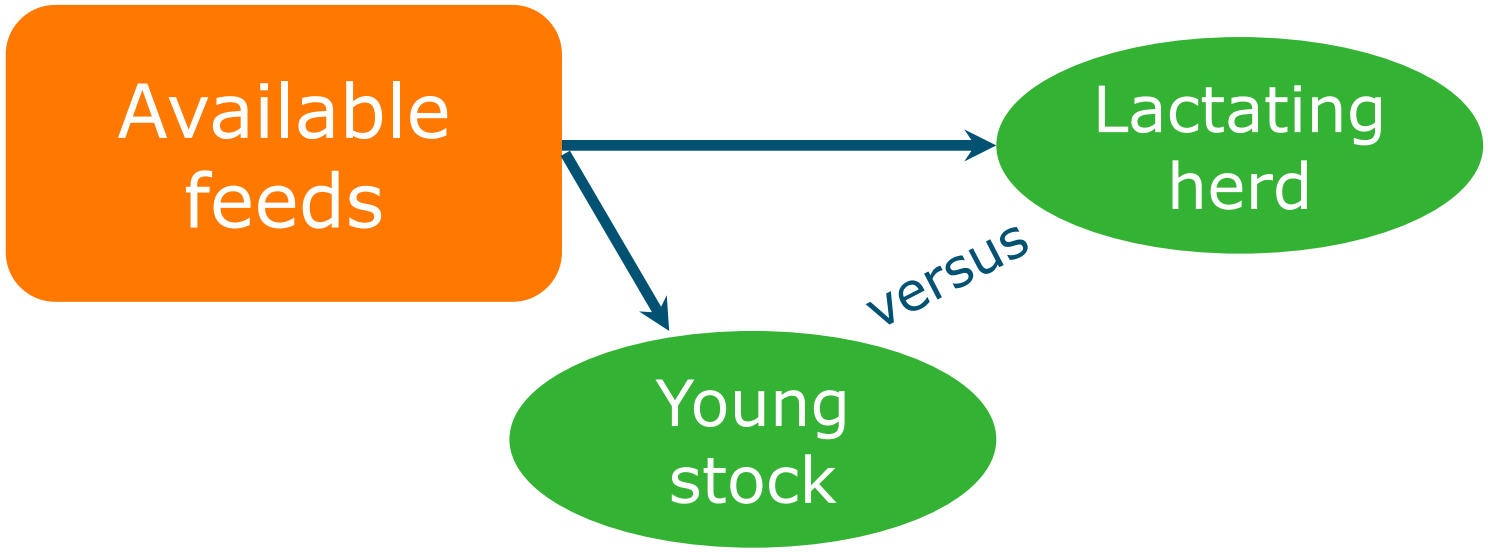
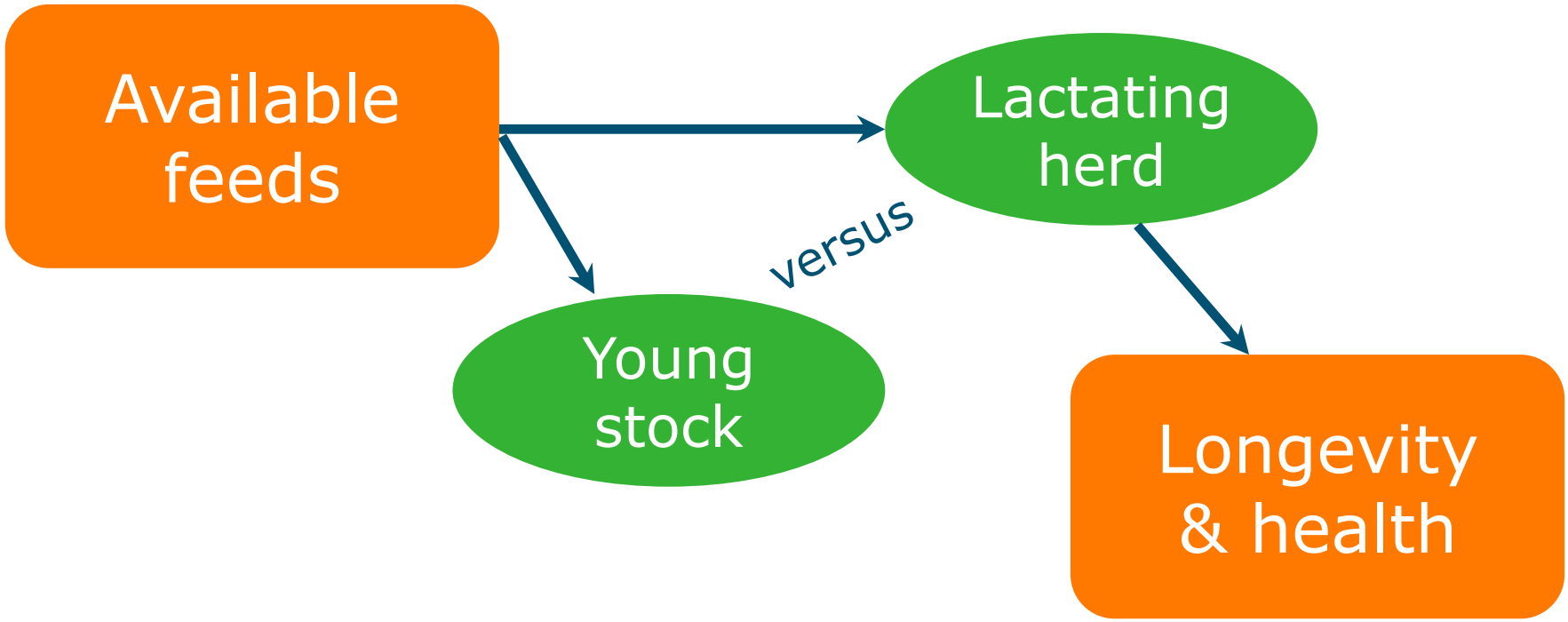
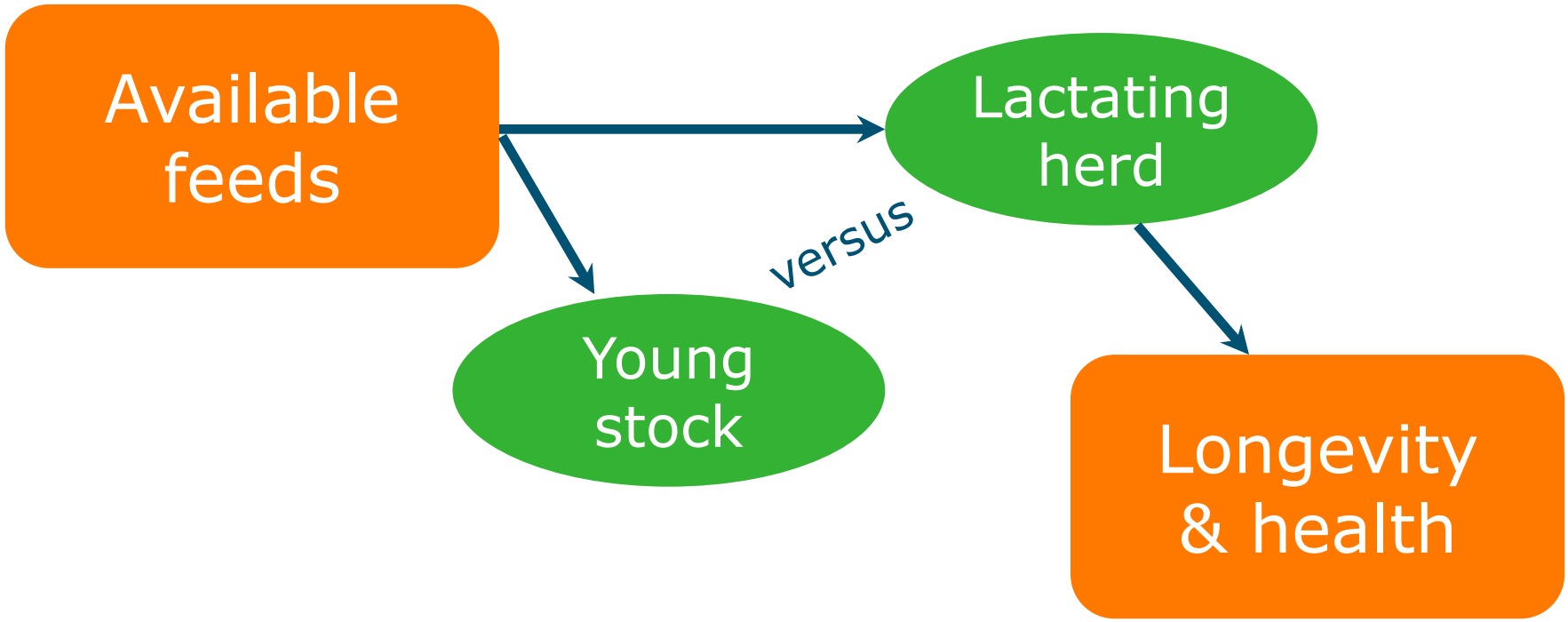
Increasing feed demands



Increasing feed demands



Increasing feed demands



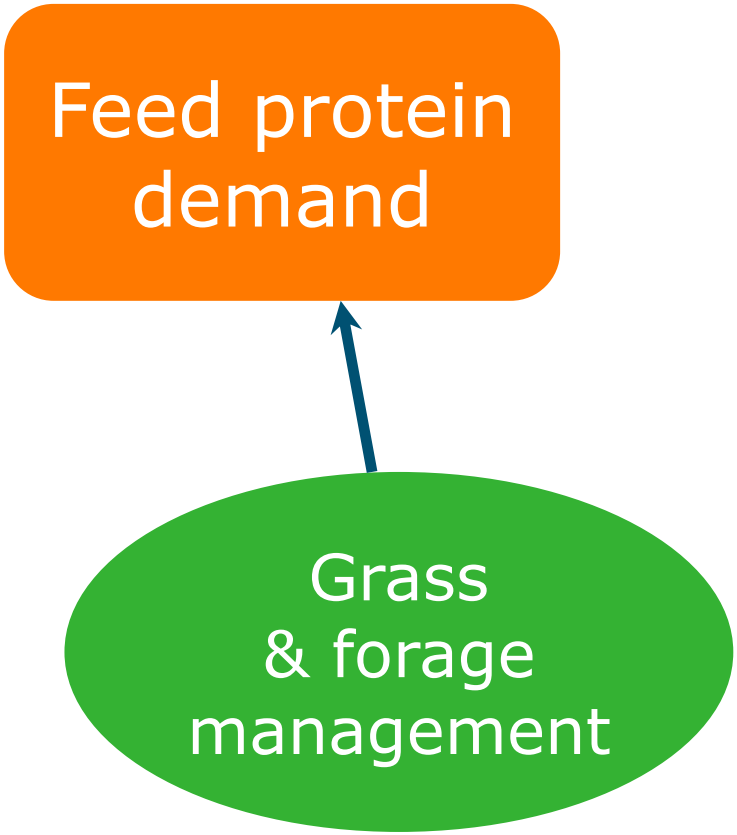
Trend 2:

more focus on longevity & health

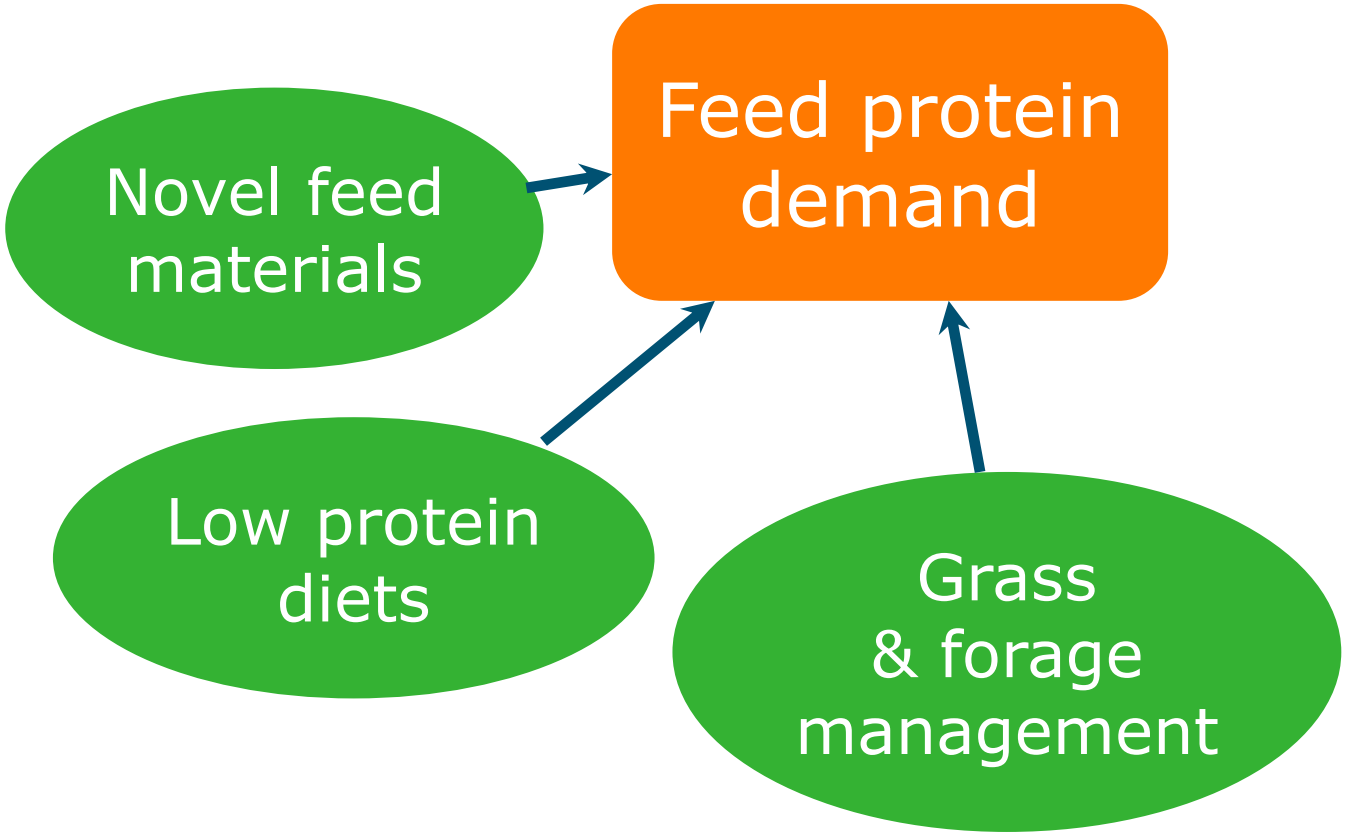
Increasing feed protein demands

Feed protein demand

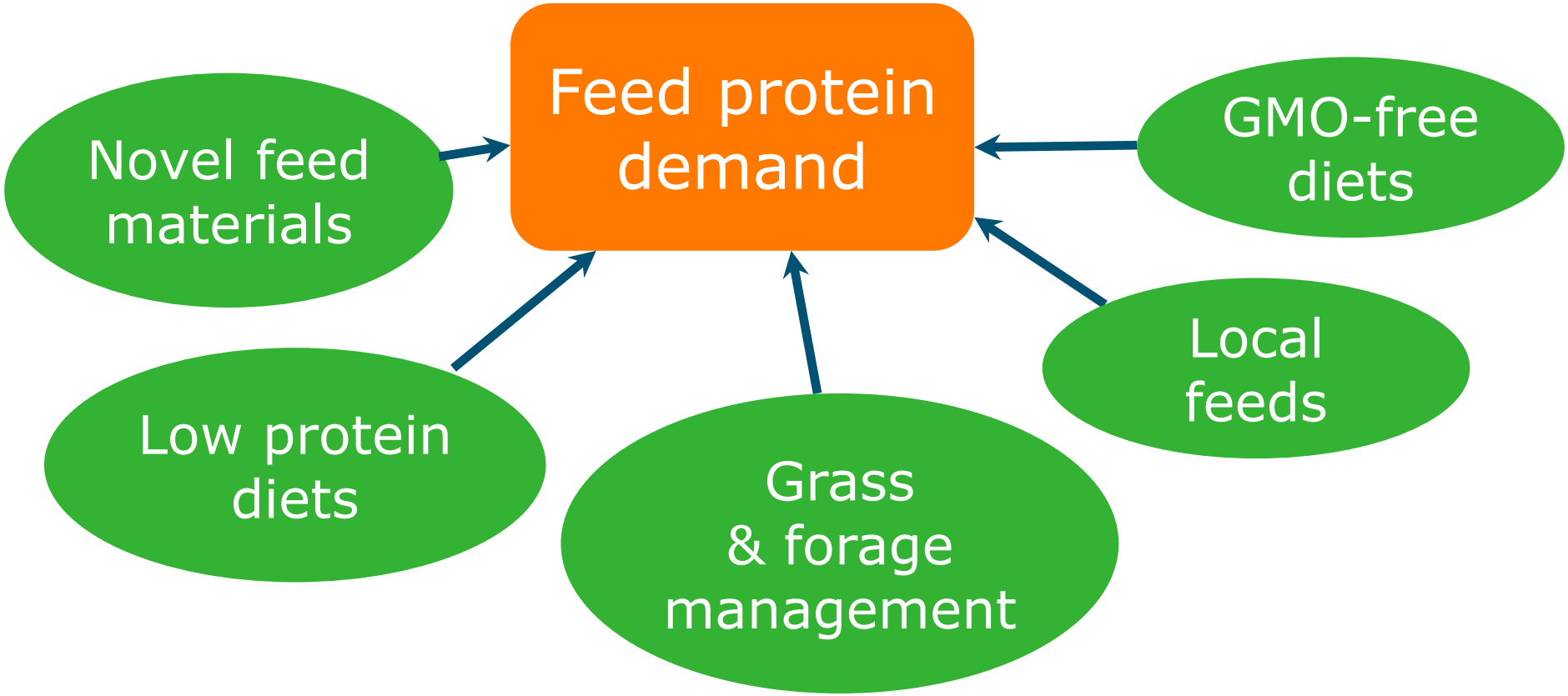
Increasing feed protein demands



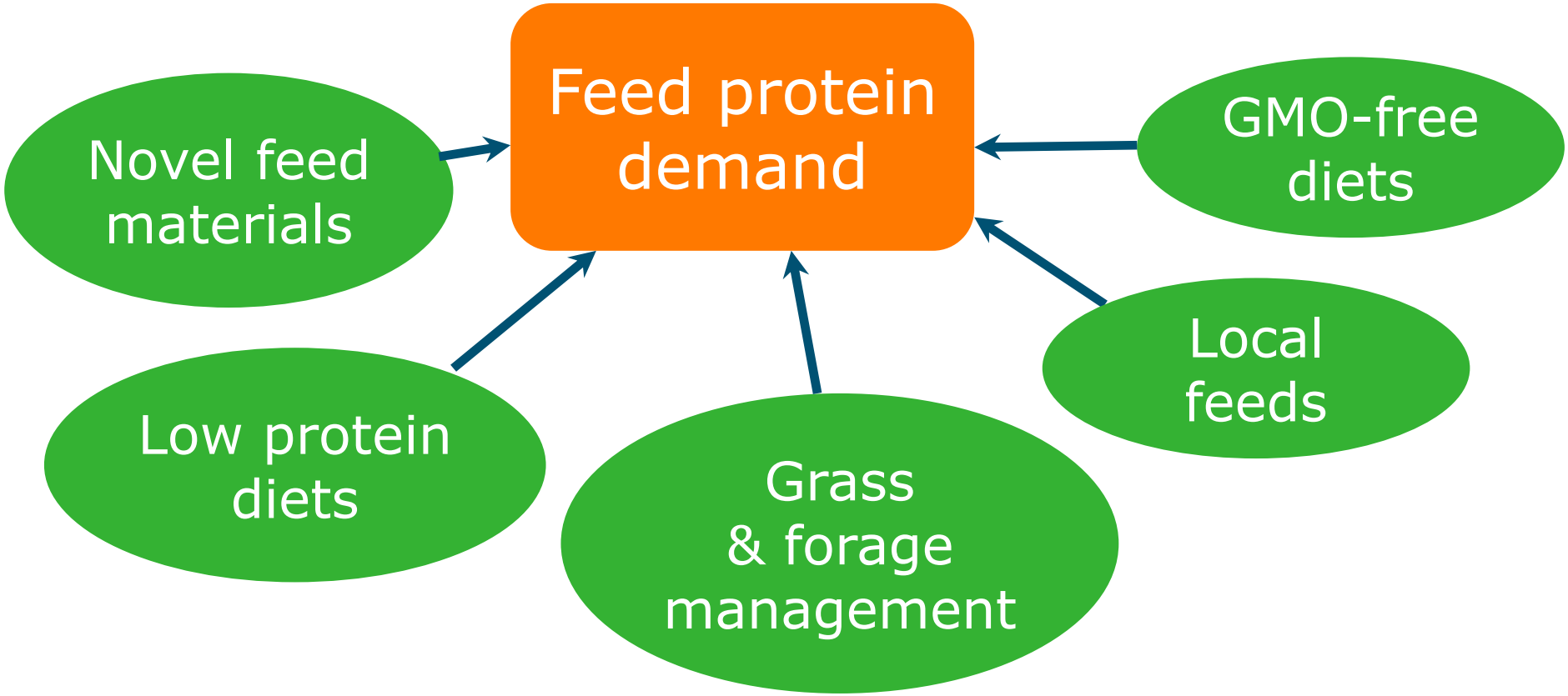
Increasing feed protein demands



Increasing feed protein demands



Increasing feed protein demands



Trend 3: renewed views on feed proteins

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Outline of this presentation: 3 trends

1. Precision livestock feeding

2. More focus on longevity & health

3. Renewed views on feed proteins

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Precision Livestock Feeding

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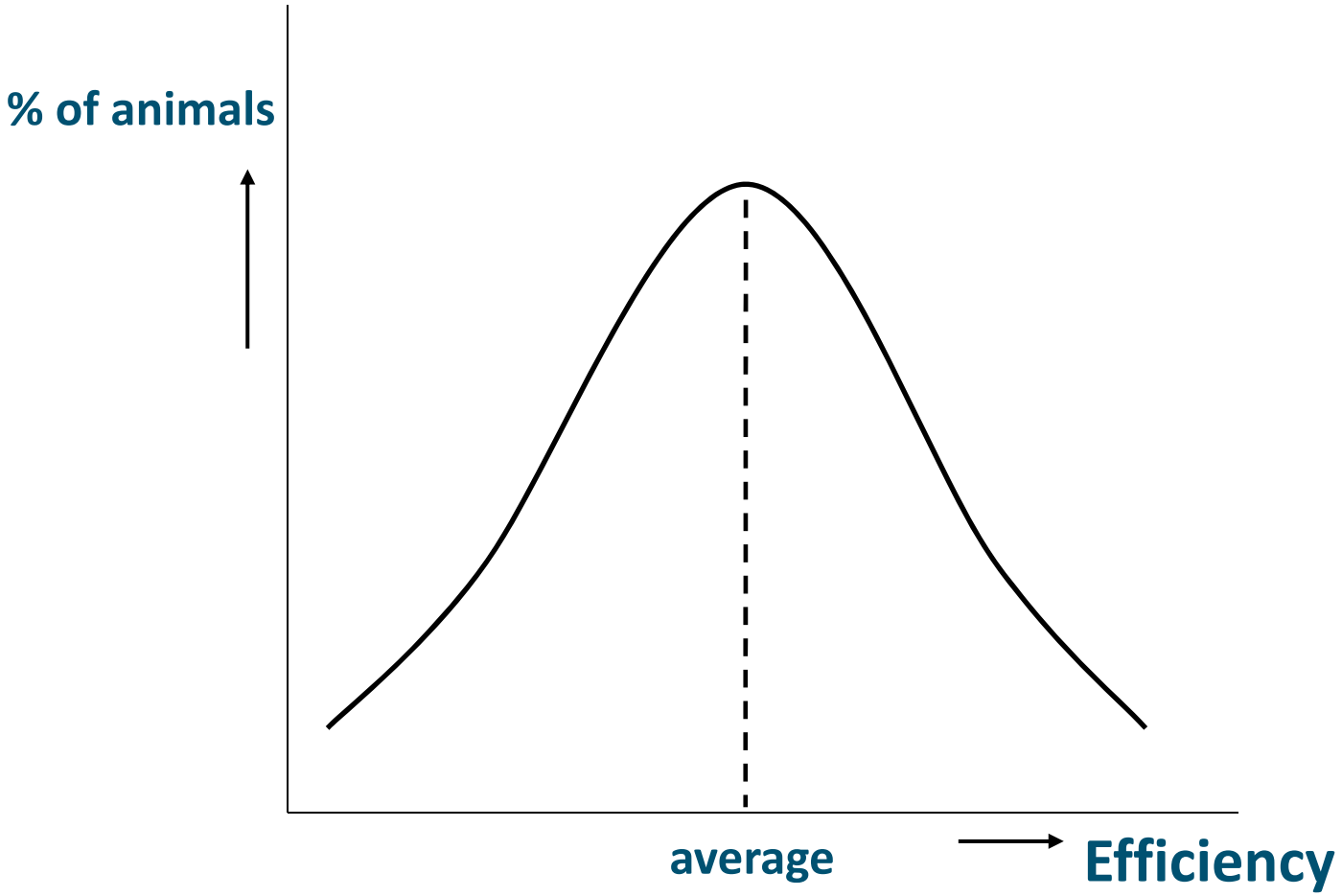
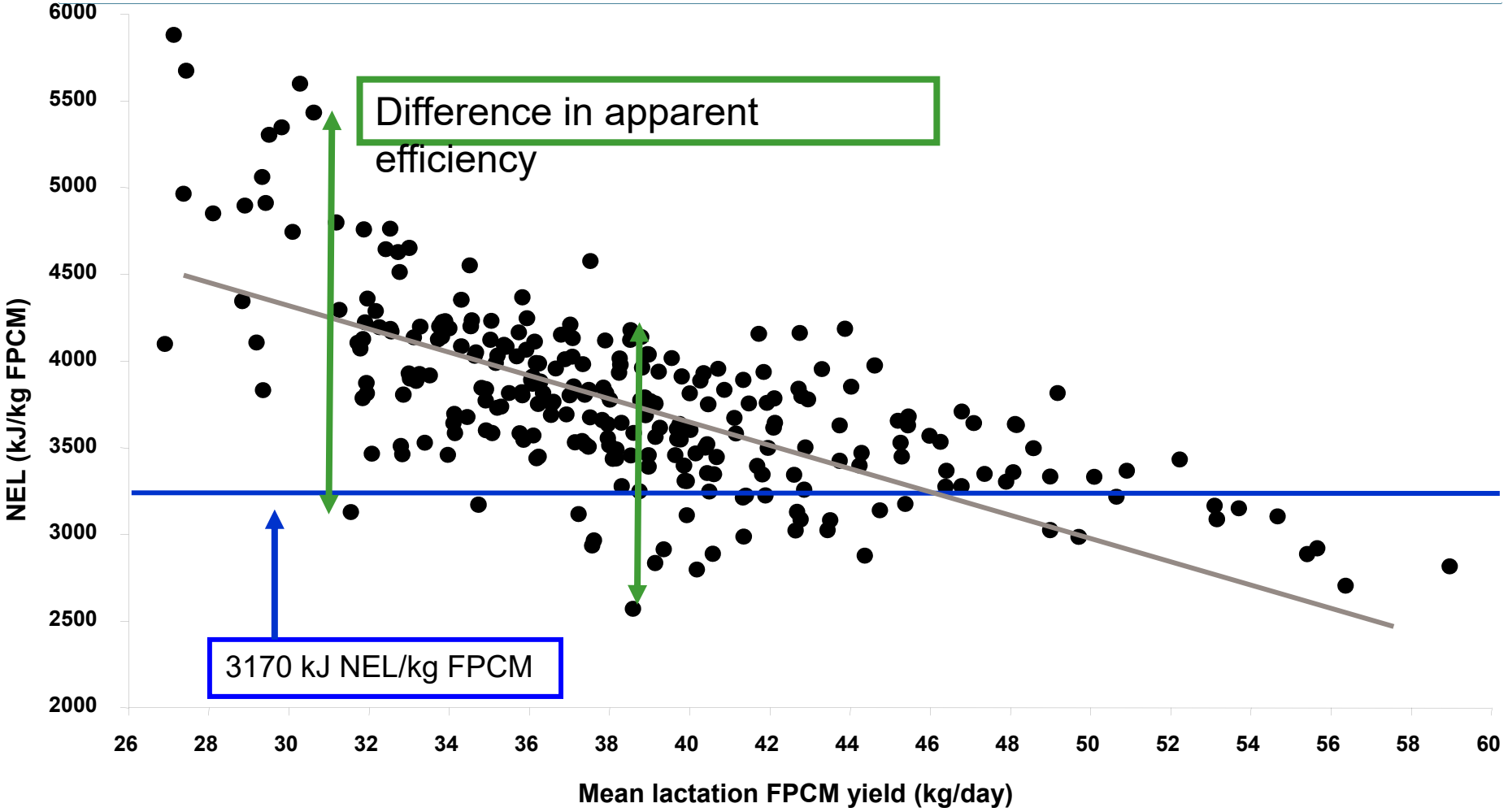
Precision feeding

- Taking into account:
  - Individual variation
  - Temporal variation

Hypothetic variation in efficiency



Individual differences in apparent efficiency



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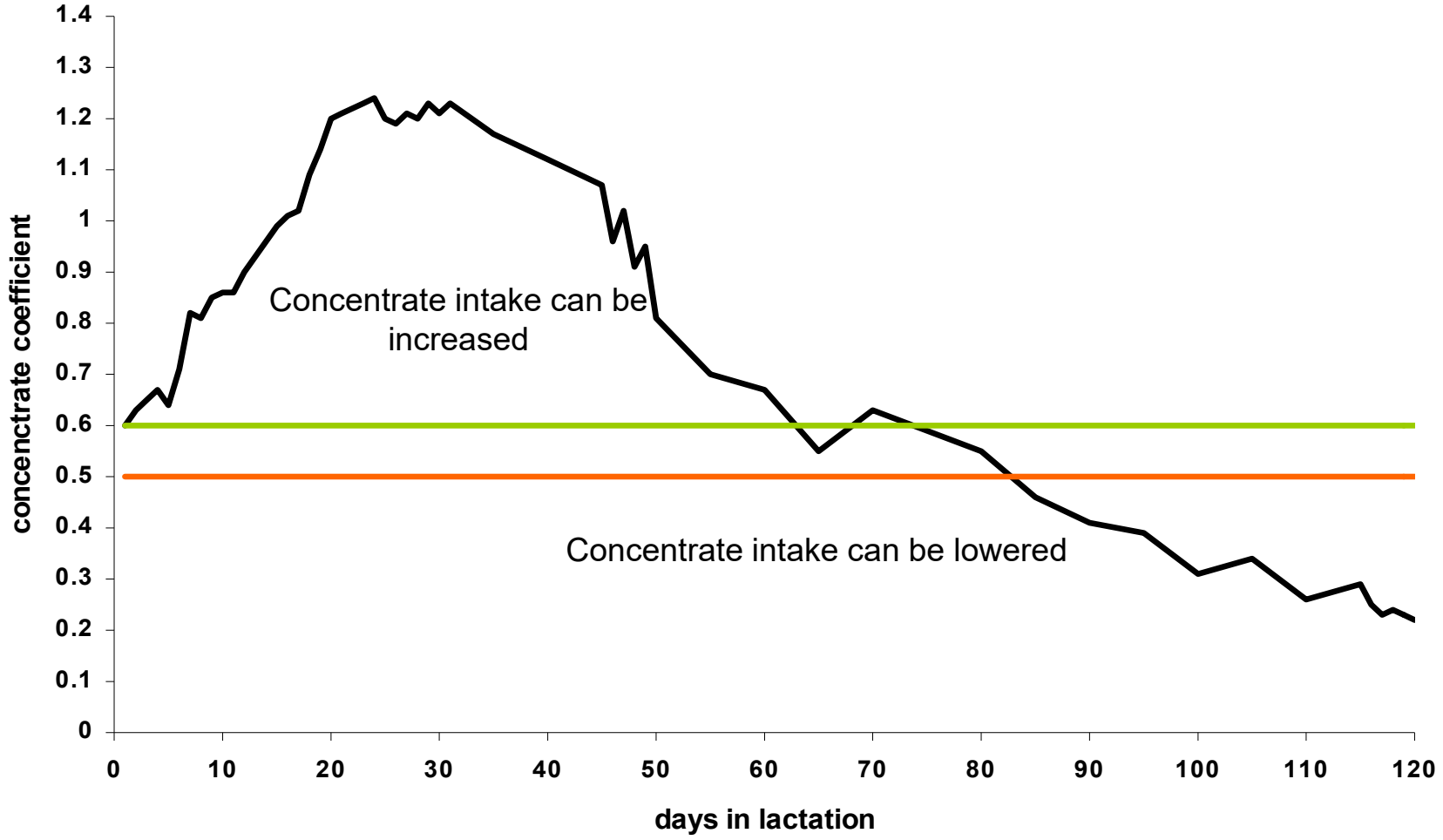
Source: Meijer et al.

Temporal variation:
efficiency differs within a cow between days



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Precision feeding

- Taking into account:
  - Individual variation
  - Temporal variation
- Using:
  - New data collection technology
  - Smart models → enable interpretation and application

New data collection: phenotypes

- Increasing amount of (real time) phenotypical data
- Measure individual as well as temporal variation
- Examples:
  - Automated body weight recording
  - Individual feed intake
  - Technology for body condition scoring
  - Monitoring of rumen conditions
  - Rumination activity
- Combine with genotype

  →New breeding characteristics

  →Nutrition x genetics

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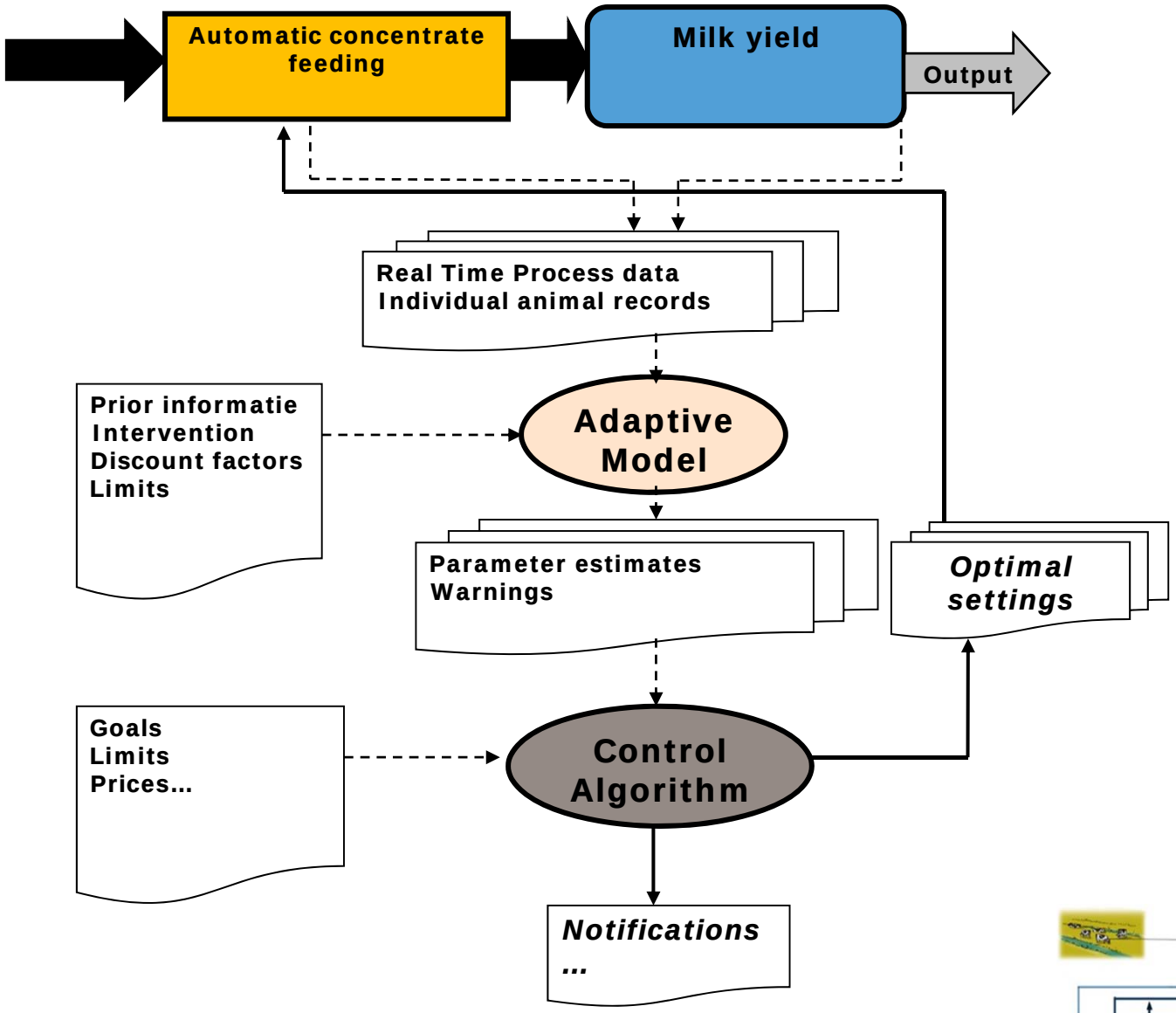

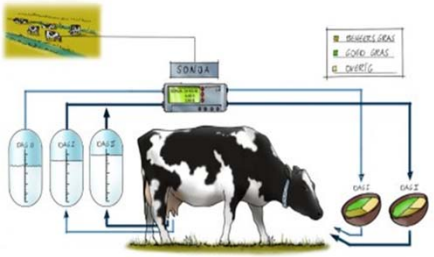

André et al, 2007

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Precision feeding

- Taking into account:
  - Individual variation
  - Temporal variation
- Using:
  - New data collection technology
  - Smart models → enable interpretation and application
- Why?
  - Early warning systems → enable interventions
  - Increase nutrient use efficiency
  - Prevent health disorders
  - Increase gross margin & profitability

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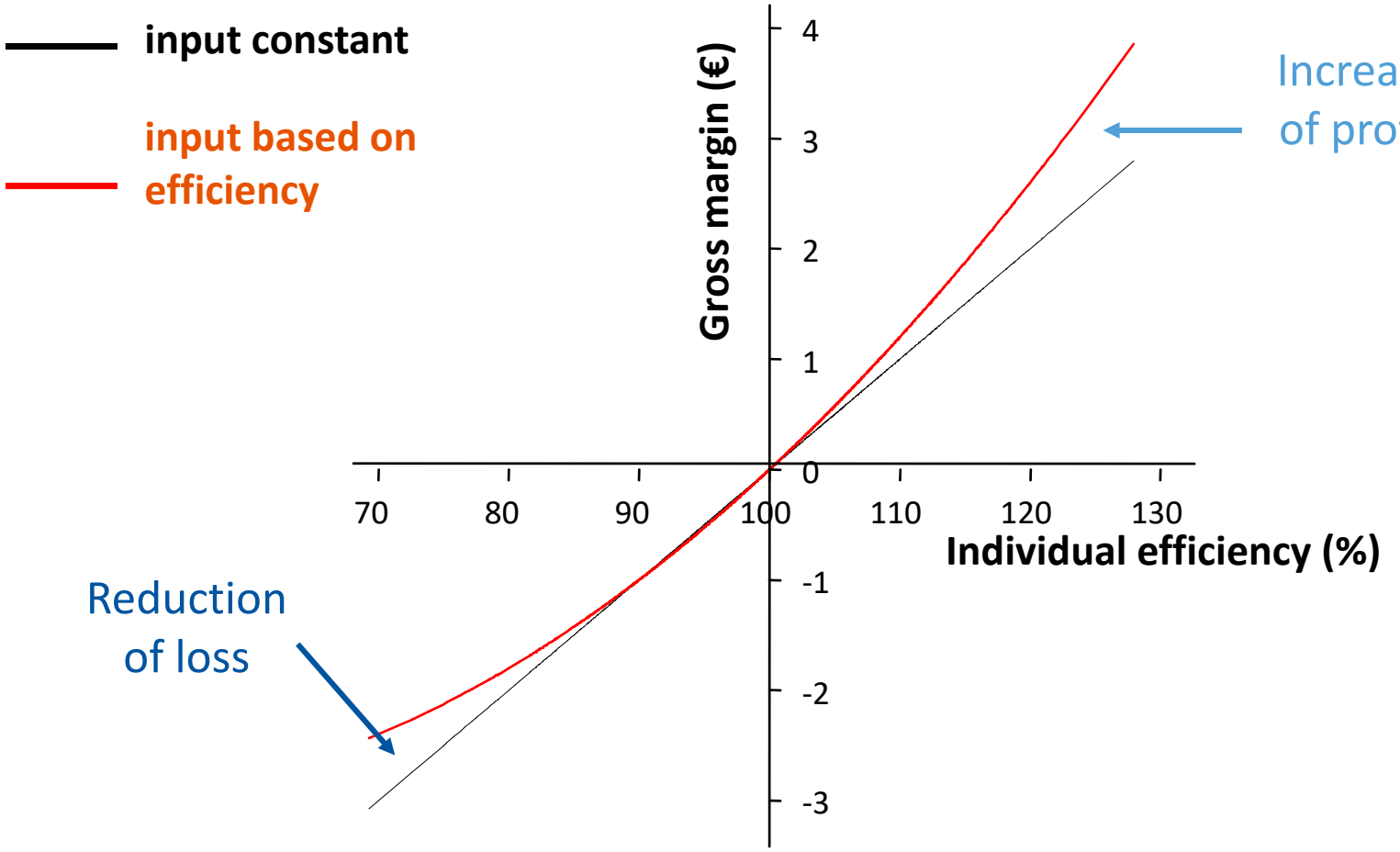
Dynamic feeding concept: variation in efficiency is used to optimise gross margin



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More focus on longevity & health

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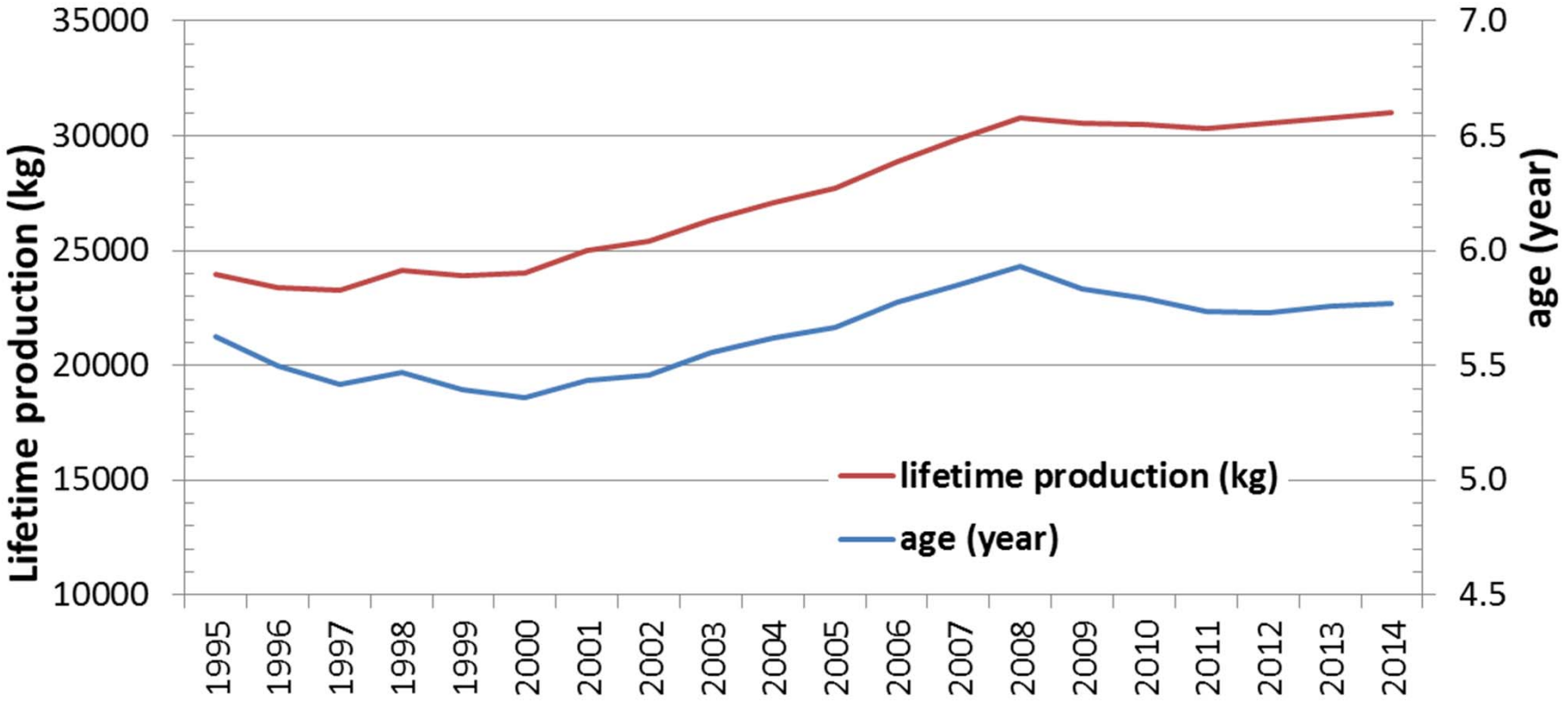
Lifetime production and lifespan (Case: the Netherlands)



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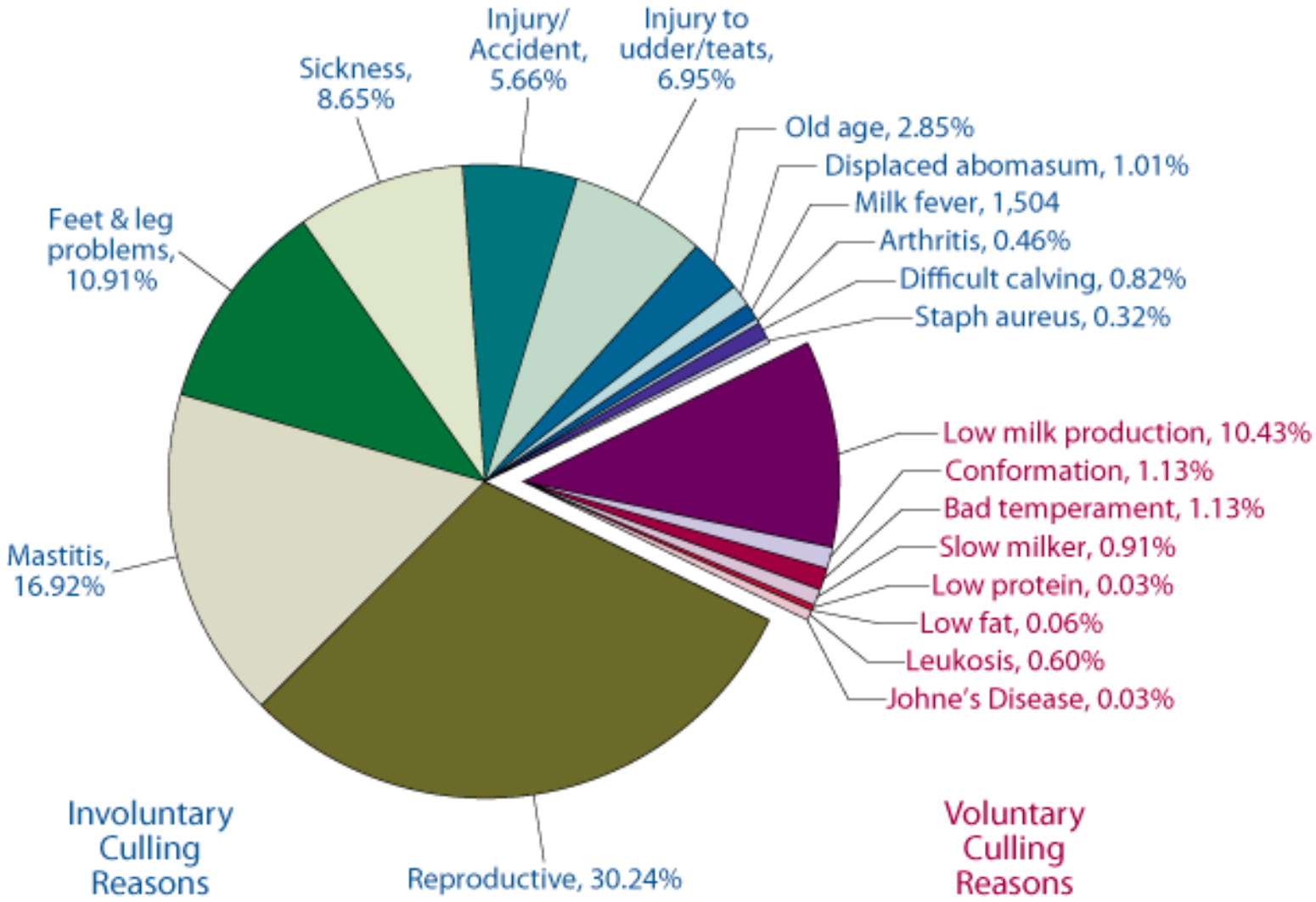
Source: CRV

Replacement rates dairy cattle

■ Ireland:	23%	*Maher et al., 2008*
■ USA:	32%	*Pinedo et al., 2010*
■ The Netherlands:	23 - 28%	*Nor et al., 2014*
■ Canada:	32 - 38%	*CanWest DHI, 2011*

86% of replacement is involuntary (Case: Canada)



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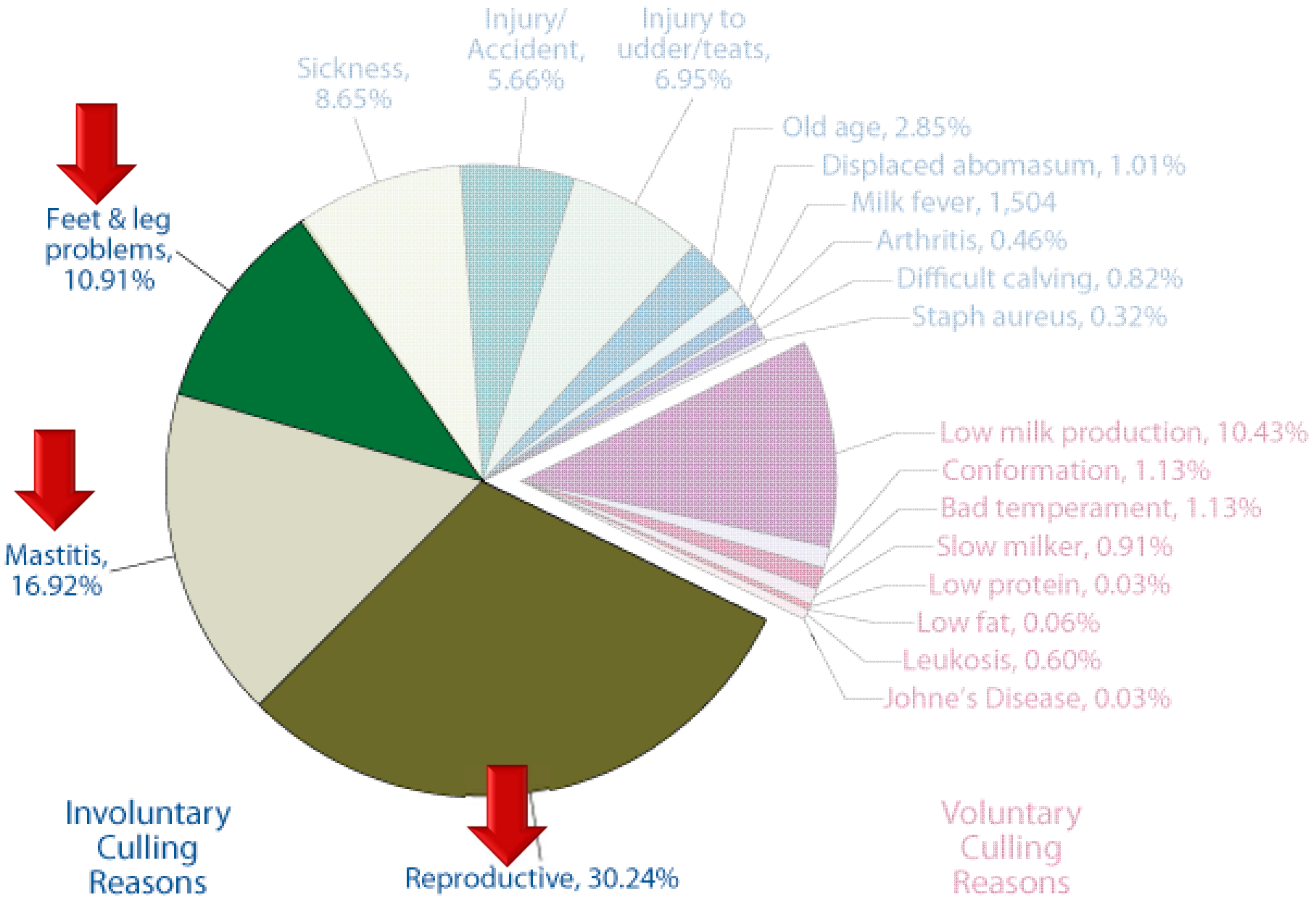
Source: CanWest DHI & Valacta
Calculations by AAFC-AID, Dairy Section



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Source: CanWest DHI & Valacta
Calculations by AAFC-AID, Dairy Section

Farmers are eager to reduce health disorders

Health → performance

Resource efficiency

Reduce antibiotic treatment

Image dairy chain

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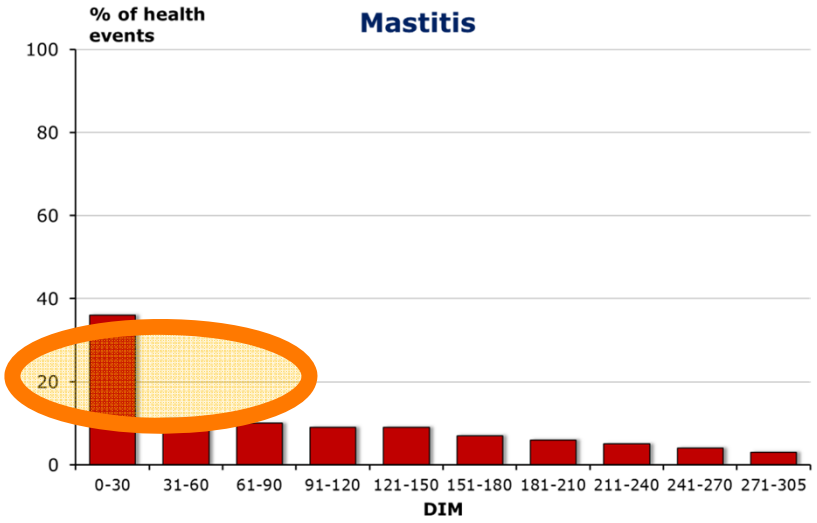
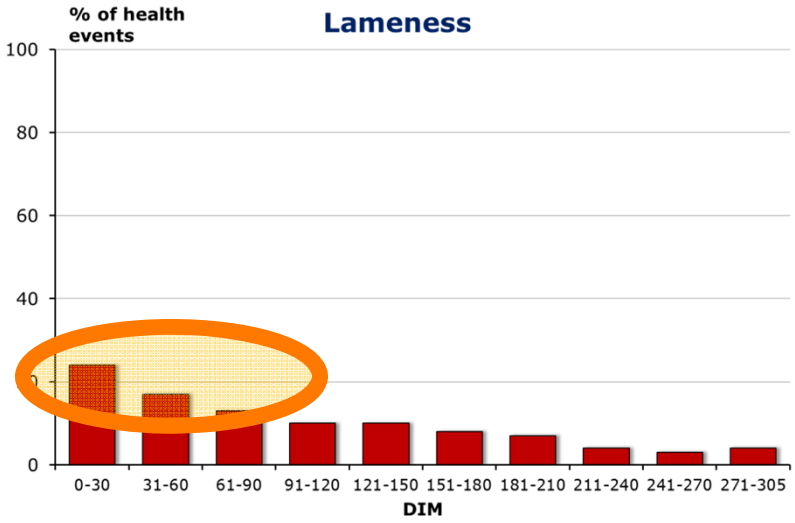
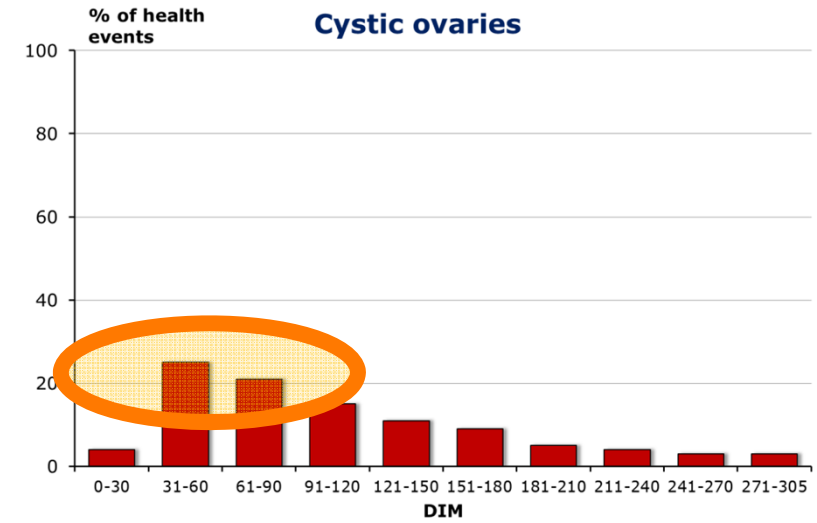
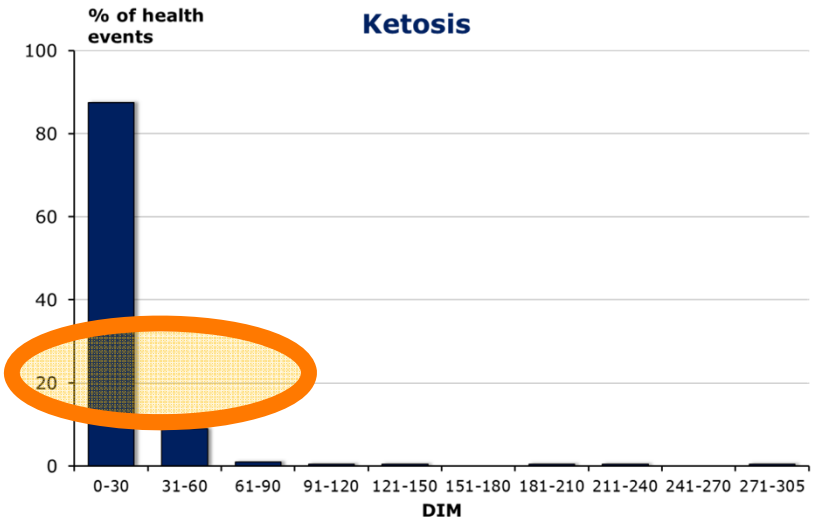
Incidence of disease









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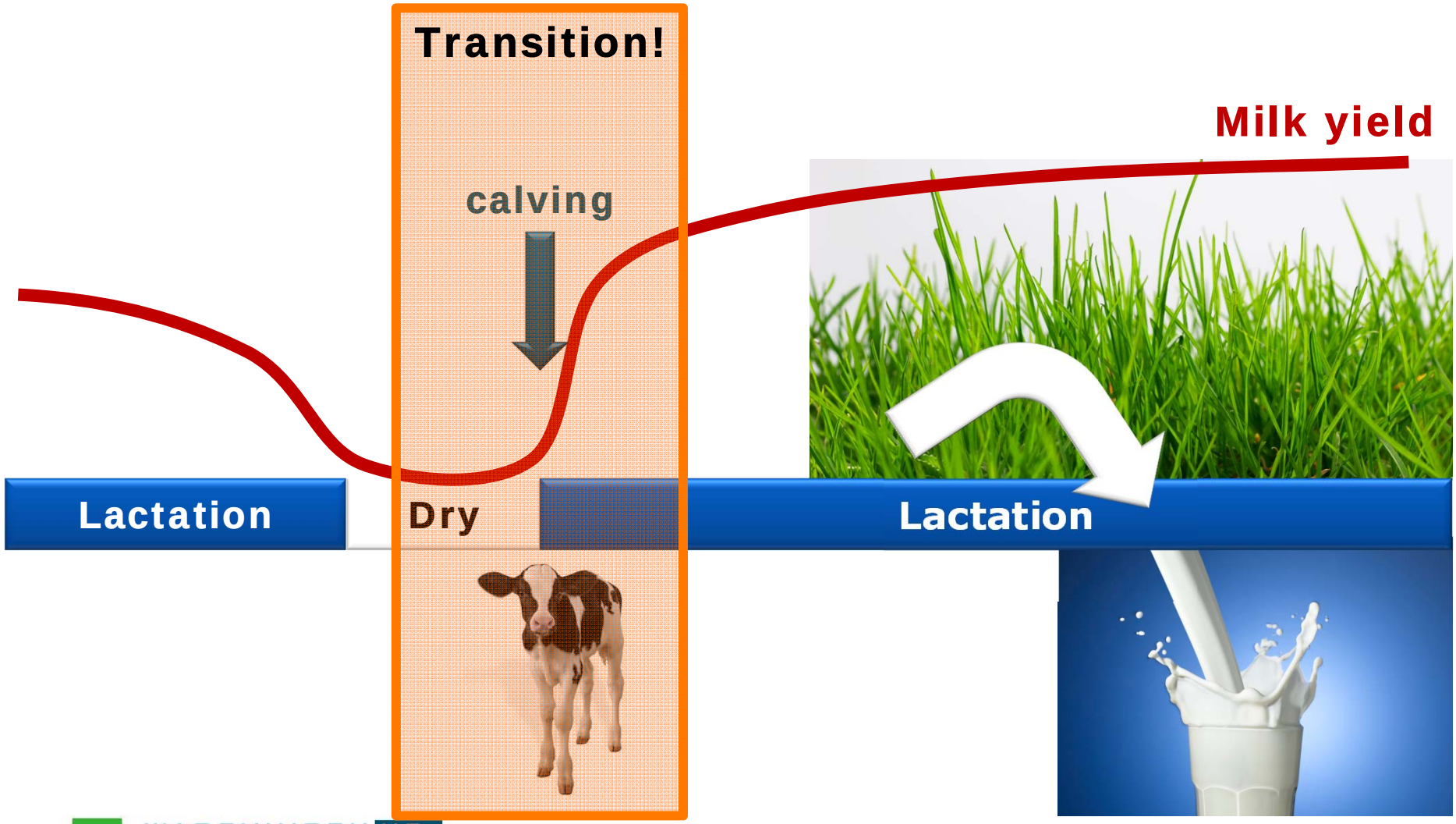
Astrid Koeck *et al*., 2012

Transition period in dairy cattle = top priority



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CAB Reviews 2014 **9**, No. 002

Metabolic adaptation during early lactation: key to cow health, longevity and a sustainable dairy production chain

Ariëtte T.M. van Knegsel[1], Harald M. Hammon[2], Umberto Bernabucci[3], Giuseppe Bertoni[4], Rupert M. Bruckmaier[5], Roselinde M.A. Goselink[6], Josef J. Gross[5], Björn Kuhla[2], Cornelia C. Metges[2], Henk K. Parmentier[1], Erminio Trevisi[4], Arnulf Tröscher[7] and Ad M. van Vuuren[6]*

Address: [1] Adaptation Physiology Group, Wageningen University, P.O. Box 338, 6700 AH, Wageningen, The Netherlands. [2] Leibniz Institute for Farm Animal Biology (FBN), Institute of Nutritional Physiology "Oskar Kellner", Wilhelm-Stahl-Allee 2, 18196 Dummerstorf, Germany. [3] Department of Agriculture, Forests, Nature and Energy (DAFNE), University of Tuscia-Viterbo, via S. Camillo De Lellis, s.n.c, 01100, Viterbo, Italy. [4] Istituto di Zootecnica, Facoltà di Scienze Agrarie Alimentari e Ambientali, Università Cattolica del Sacro Cuore, 29122 Piacenza, Italy. [5] Veterinary Physiology, Vetsuisse Faculty, University of Bern, Bremgartenstr. 109a, 3001 Bern, Switzerland. [6] Wageningen UR Livestock Research, P.O. Box 65, 8200 AB Lelystad, the Netherlands. [7] BASF SE, G-ENL/MT - F31, 68623 Lampertheim, Germany.

***Correspondence**: A. M. van Vuuren. Email: ad.vanvuuren@wur.nl

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The electronic version of this article is the definitive one. It is located here: http://www.cabi.org/cabreviews

Abstract

Enhancing longevity by reducing involuntary culling and consequently increasing productive life and lifetime production of dairy cows is not only a strategy to improve a farm's profit, but is also

Research challenges transition cows

- Scientists and industry R&D will develop more in-depth knowledge on role of:
  - Specific nutrients (e.g. glucogenic, lipogenic)
  - Feed additives
  - (Feeding) behaviour
  - Gene-nutrient interactions
  - Stressors and immune responses
  - ...
- Translation into customised nutrition and management strategies for (individual) cows

Renewed views on feed proteins

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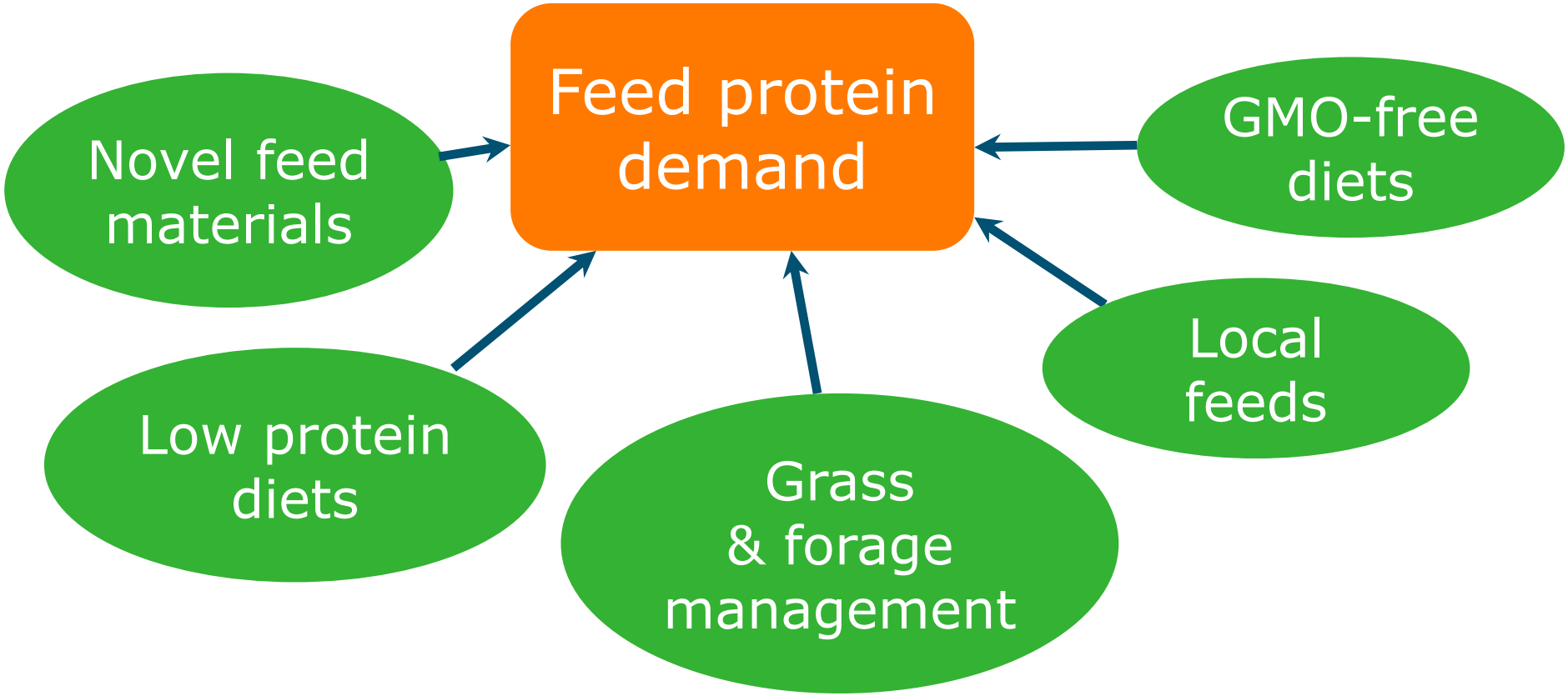
Increasing feed protein demands



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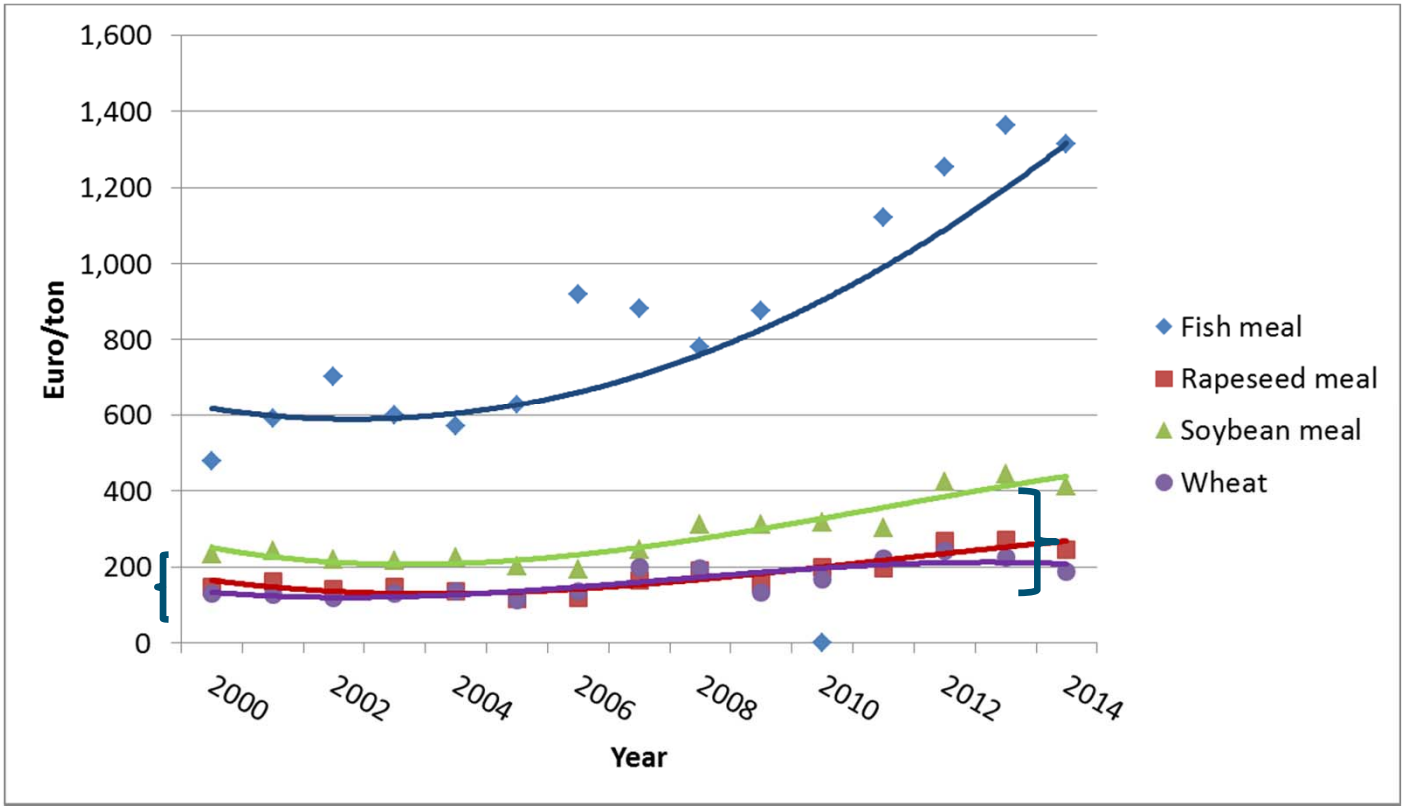
Price development of feed ingredients

- *Price soybean meal: from 2000 – 2014 doubled*
- *Since 2009: increasing contrast between price soybean meal and wheat*



Scarcity of protein sources for feed?

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Agrimatie.nl

LEI, 2015

Protein balance in EU-27 (2012-2013)

Category	EU-production (x 1000 ton protein eq.)	EU-consumption (x 1000 ton protein eq.)	Rate of self sufficiency (%)
Soybeans	344	14.280	2%
Rapeseed/ Sunflowerseed	5.022	6.795	74%
Legumes	424	450	94%
Total all proteins	7.391	23.800	31%

(Fefac, 2015)

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Policy to reduce feed protein imports

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Increasing interest in non-GMO diets

- Non-GMO labels increasingly relevant in European dairy production
- Non-GMO feed
  - Replace GM soy products by non-GM alternatives
  - Rape seed, peas, beans, lupins, sunflower seeds
- Trend towards the use of local feed materials
  - Grass based production
  - Protein crops
- Critical: availability, amino acid composition, price, ...

Compound feed costs: simulation study

- 3 compound feeds: standard, medium, high protein
- 2 scenarios:
  - All feed materials may be included
  - No Latin American soy products
- Compound feed costs compared for these 3 x 2 = 6 cases
- Raw material prices: average July 2014 - June 2015
  - € /100 kg; delivered to feed company; excl. VAT
  - Least cost formulation (Bestmix)

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Compound feeds costs per scenario

	Protein level (g DVE/kg)		
	low	medium	high
Scenario	**90**	**120**	**180**
1 Standard situation	15.35	18.20	25.41
2 Without soy bean products	15.66	18.45	28.83
Extra costs scenario 2	**0.31**	**0.25**	**3.42**

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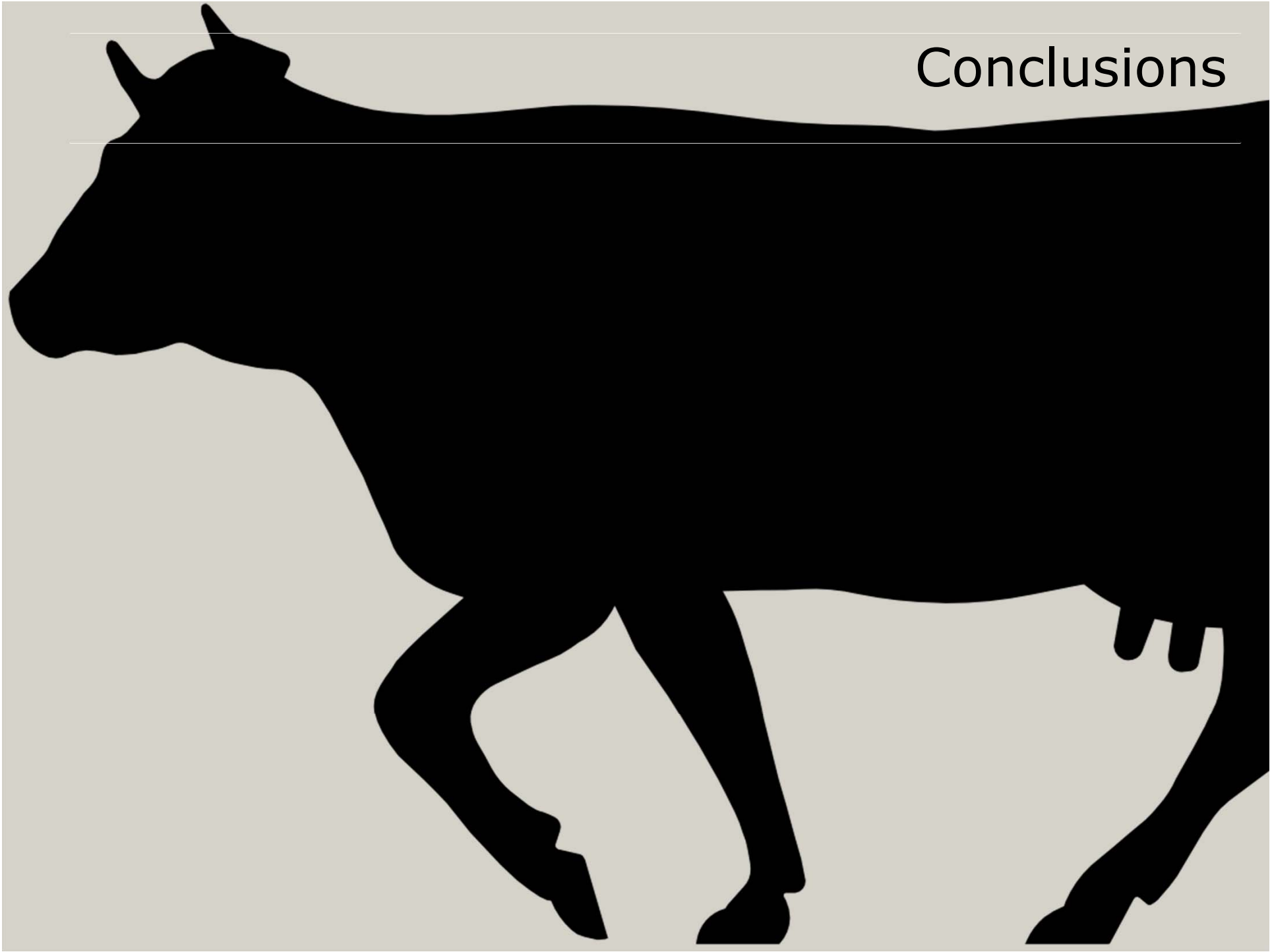
DVE = Dutch standard for ileal digestible protein

Challenges

- Reduce the use of non-EU proteins
- Improve use of grass, forages, protein crops, crop residues
- Low protein diets
- Novel feed proteins
    - By-products from food & biofuel industry
    - By-products from new biorefinery technologies
    - Aquatic proteins
    - ...
- Amino acid based diet formulation

Conclusions



Major trends in dairy cattle nutrition, post-quota

- Precision Livestock Feeding concepts
- More focus on longevity & health
- Renewed views on feed proteins

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gert.vanduinkerken@wur.nl