NATURAL RESOURCES INSTITUTE FINLAND

BioTalks: Viable and resilient dairy farming!

Current and future management tools to modify milk production of cows

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Cattle play an important role in Finnish food chain and bioeconomy

Luke covers all parts of the dairy chain

Effect of feeding strategies to the cow, end products, sustainability, circular economy, security of supply

FEED
Grass-based diets provide ecosystem services
Composition & preservation
Controlled microbiome
Balanced ration formulation

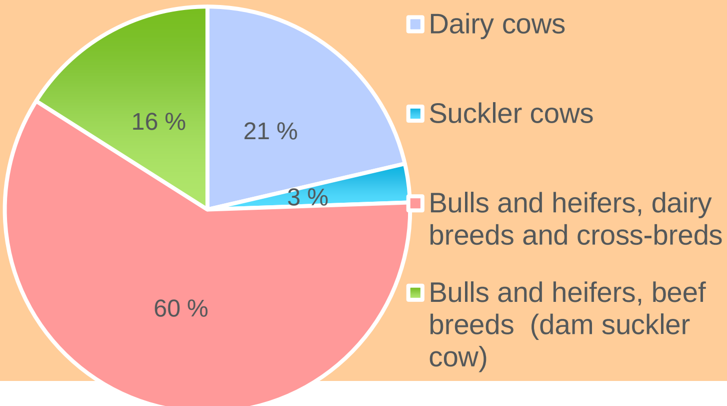
COW - Transforming feed into milk and meat
Genetics + breeding
Rumen microbiome & digestion kinetics
Metabolism (energy, nitrogen & fat)
Health & welfare

MILK, MILK PRODUCTS and MEAT
Production efficiency
Product quality and safety
Added value products

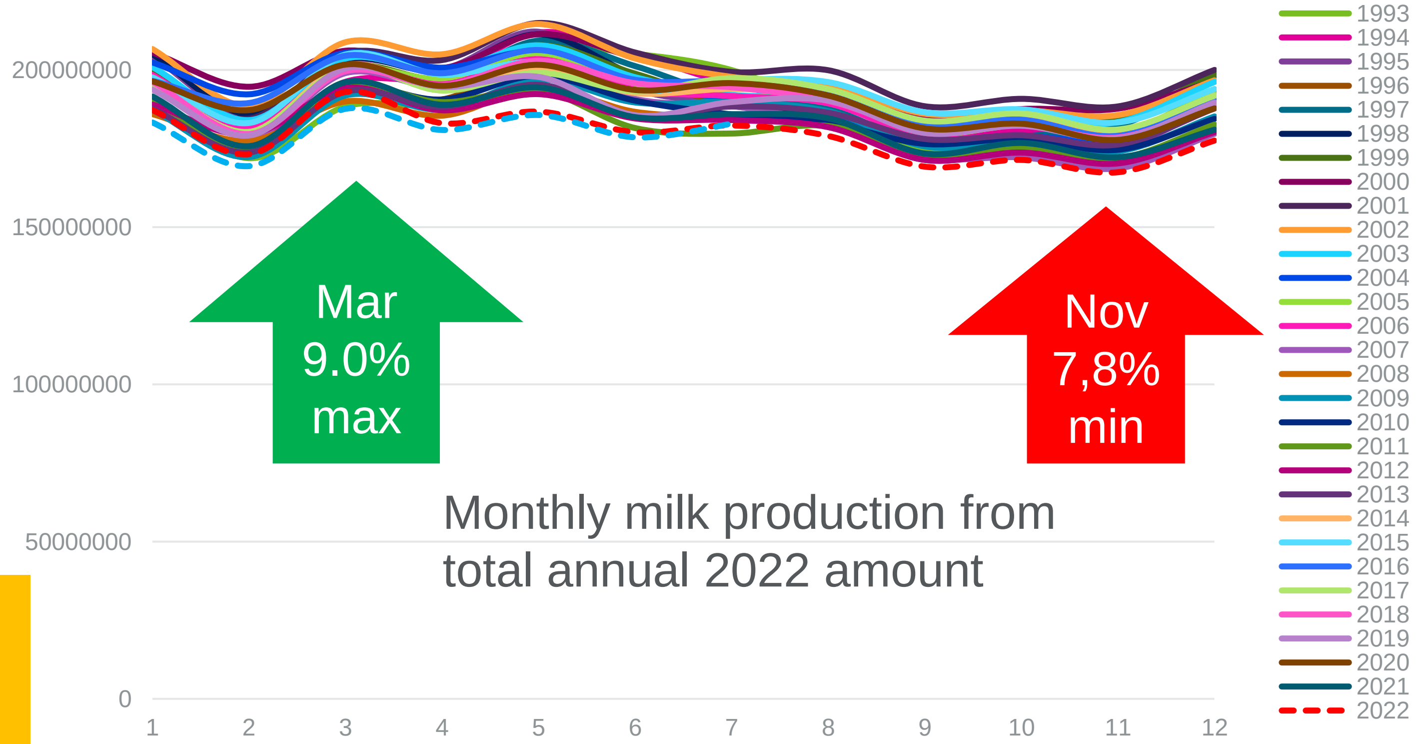
Milk primary production in 2022

- Currently ca 5000 dairy farms
- The farm size keeps growing, but currently the mean herd size is 50 cows per farm
- Investing dairy farms typically install 2 or more automatic milking systems (120+ dairy cows)
- Average milk production per cow is ca 9000 kg / year

Beef originates from following animal groups – integration of dairy and beef production (Finland 2020)

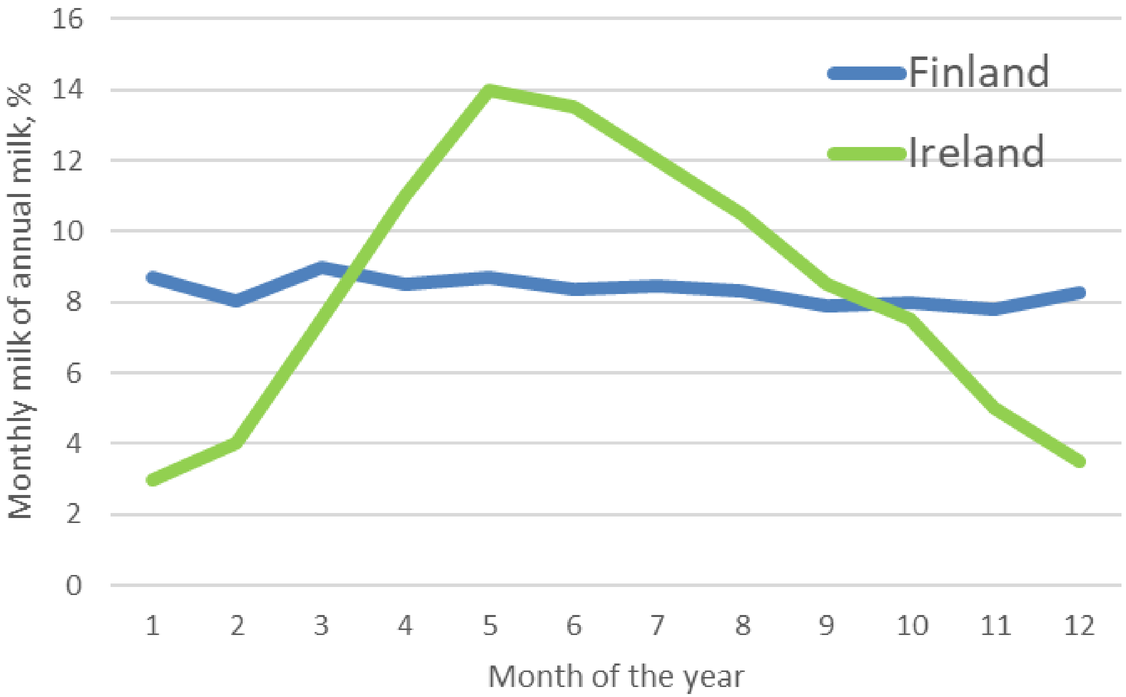


The amount of milk received by the dairies throughout the year is rather constant in Finland

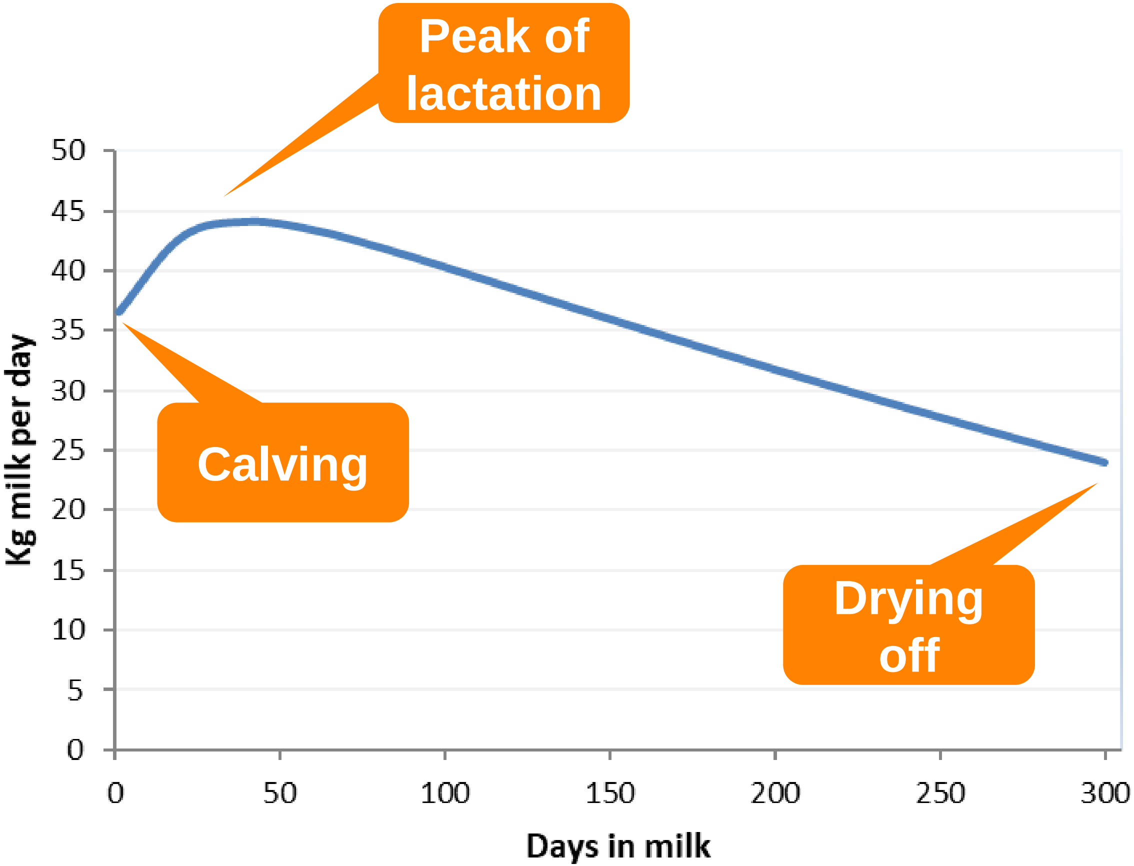


Data retrieved from stat.luke.fi

In other parts of the world, there are very different approaches. For example Ireland maximizes pasture feeding and exploits seasonal variation.



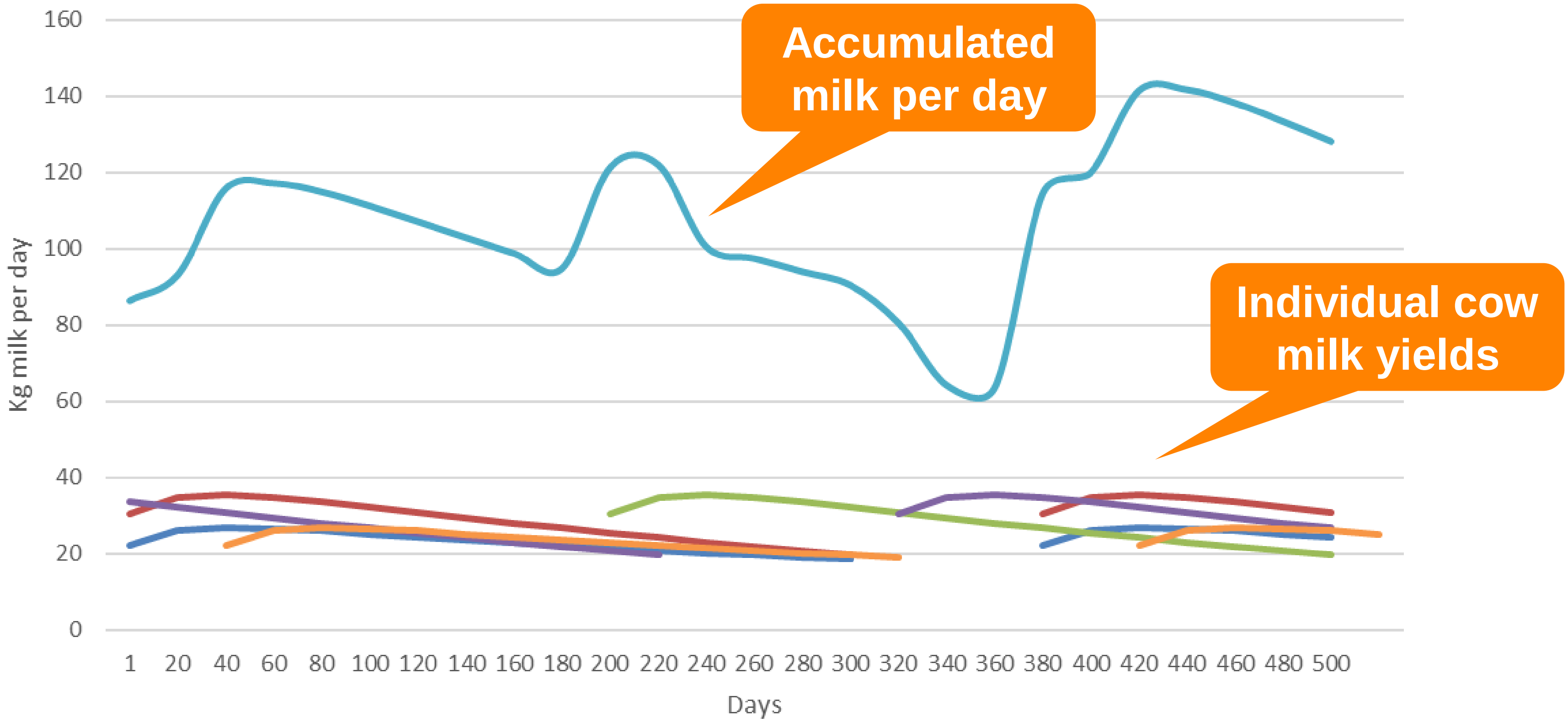
Standard lactation curve of a cow



- Average age at calving: 25.5 months
- Average calving interval: 403 days
- Average days dry: 66

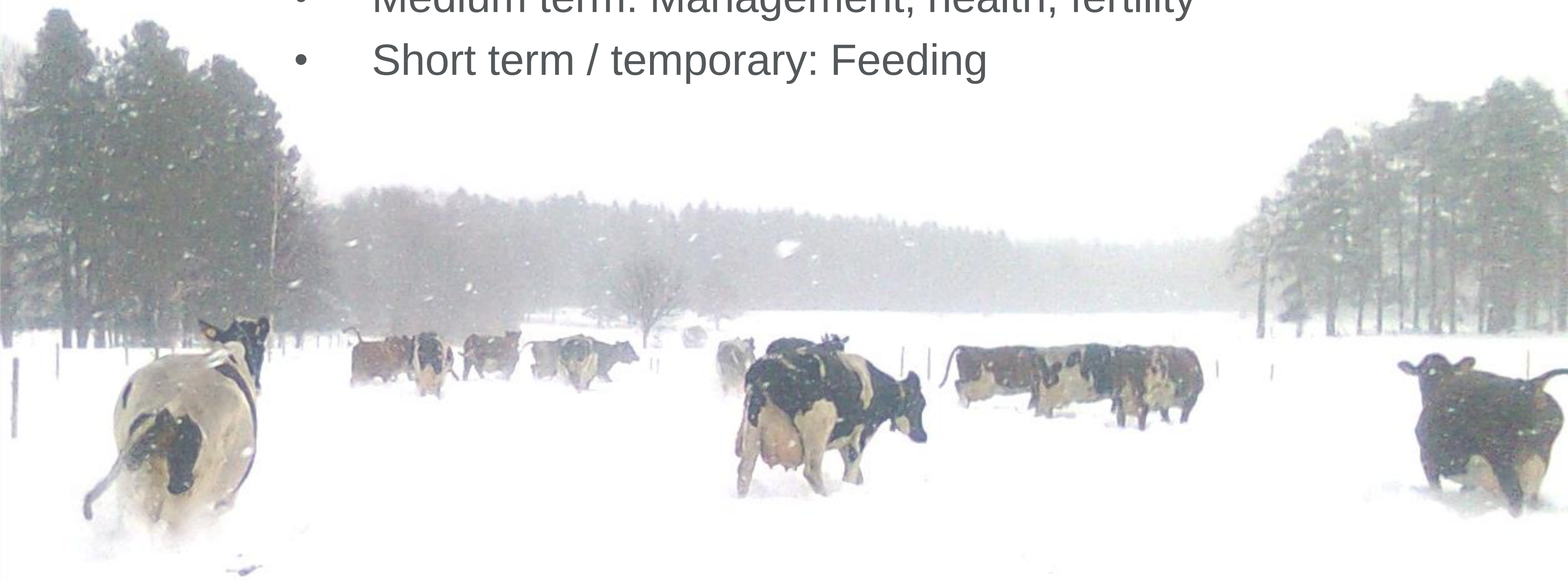
- Source: ProAgria

Whole herd milk output is accumulated from the individual lactation curves of the cows:



Different methods to modify milk production vary in speed and persistency

- Long term / permanent: Genetic potential of the cows
- Medium term: Management, health, fertility
- Short term / temporary: Feeding

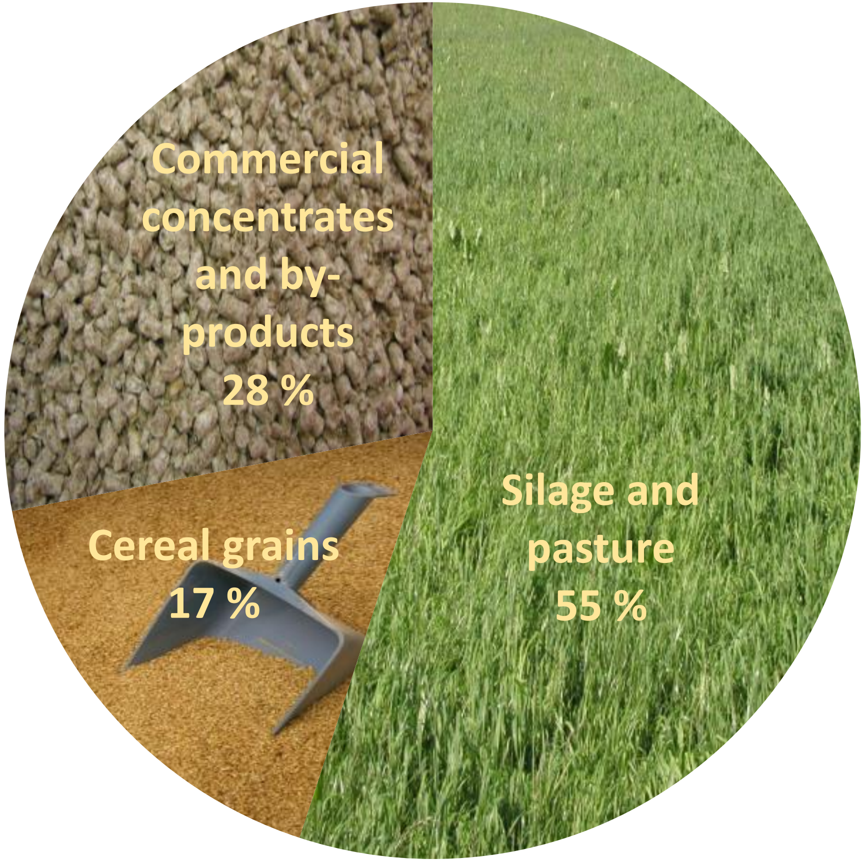


How to modify the milk production over time?

- Timing of calvings is a key parameter affecting seasonal variation in milk production
- Extended lactation could be one approach to effecticely change the calving pattern
  - Strategically delayd insemination – increased interval between calvings
    - Calving is the most risky phase of cow's life
    - Less calves for beef production
- Short term changes can be achieved by feeding

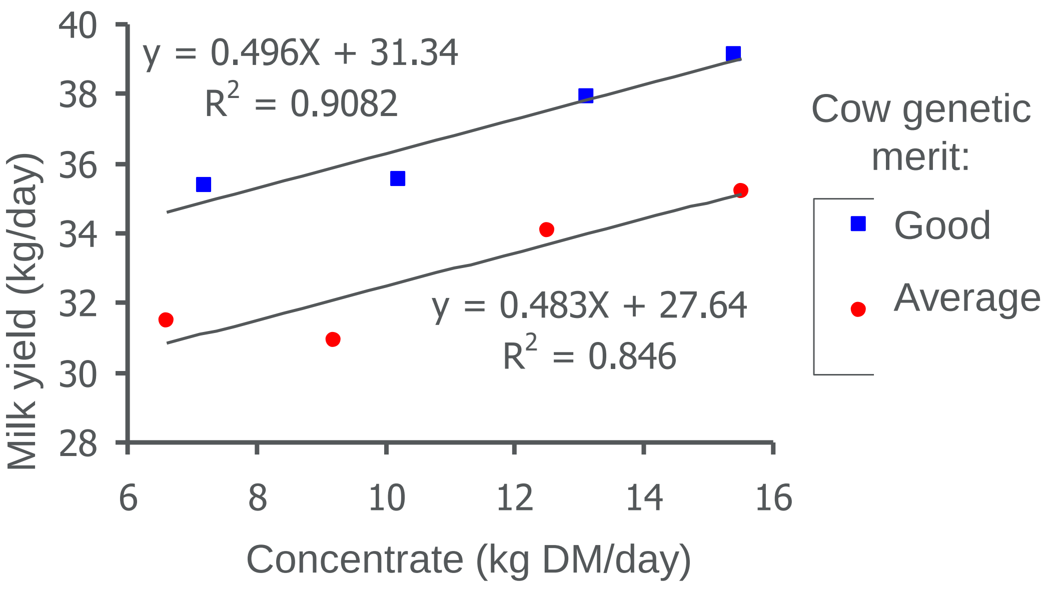
Dairy cow diet in Finland in 2022 Source: ProAgria

Up to 72 % produced on-farm



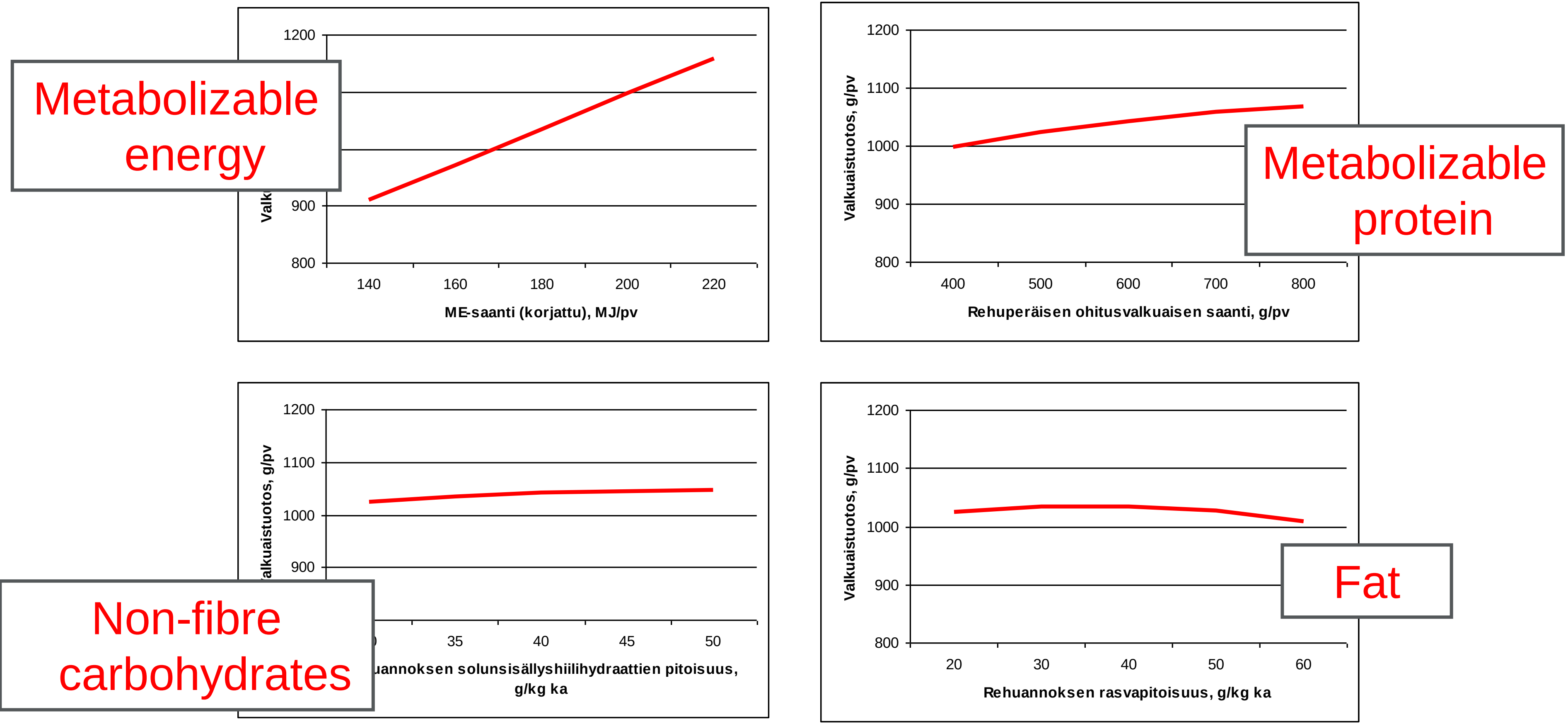
In general: Genetics vs feeding intercations are rare

Increasing the level of concentrate increases milk yield in a similar manner irrespective of the genetic merit of the cows, but the difference in the level of production persists

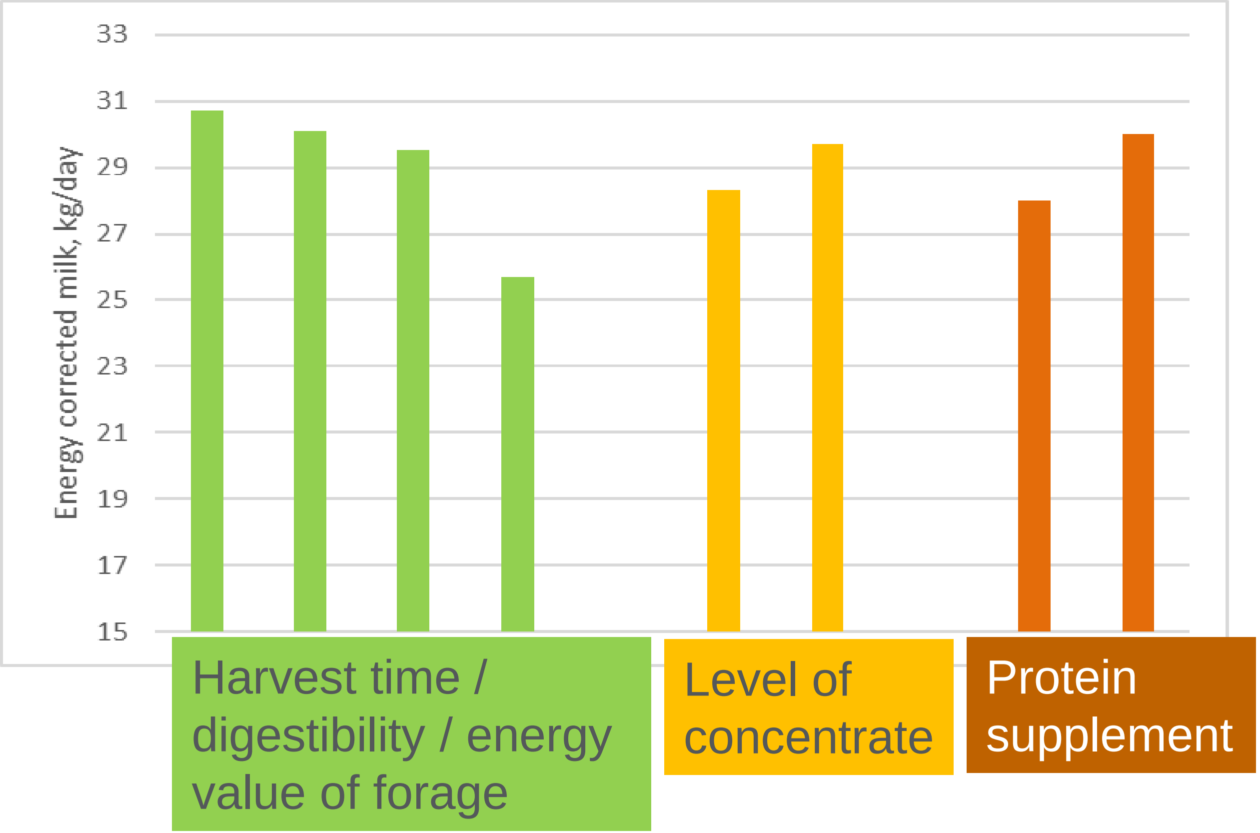


Ferris, C.P., Gordon, F.J., Patterson, D.C., Mayne, C.S. & Kilpatrick, D.J. 1999. The influence of dairy cow genetic merit on the direct and residual response to level of concentrate supplementation. Journal of Agricultural Science, Cambridge, 132: 467-481.

Milk (protein) output is a response to amount of energy and/or nutrients available to the dairy cow

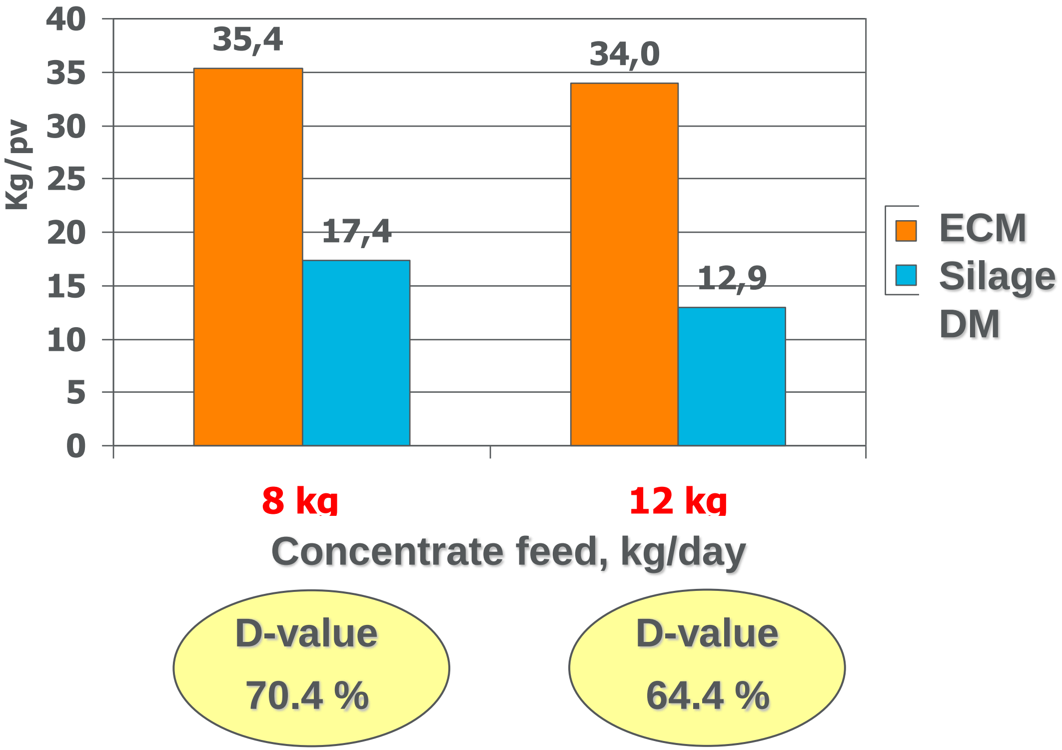


Dairy cows respond to various types of feeding treatments – intreactions generally missing



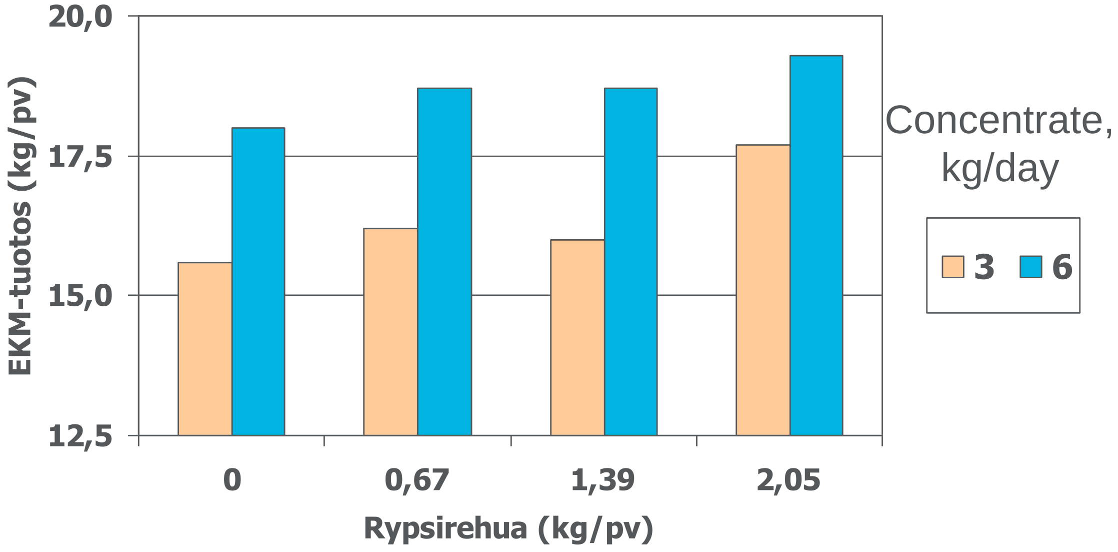
Rinne, M., Jaakkola, S., Kaustell, K., Heikkilä, T. & Huhtanen, P. 1999. Silages harvested at different stages of grass growth *versus* concentrate foods as energy and protein sources in milk production. Animal Science 69: 251-263.

How you wish to think about it – with very different diets it is possible to reach the same milk output. But with very different on-farm feed production strategies, and amounts of purchased feeds.



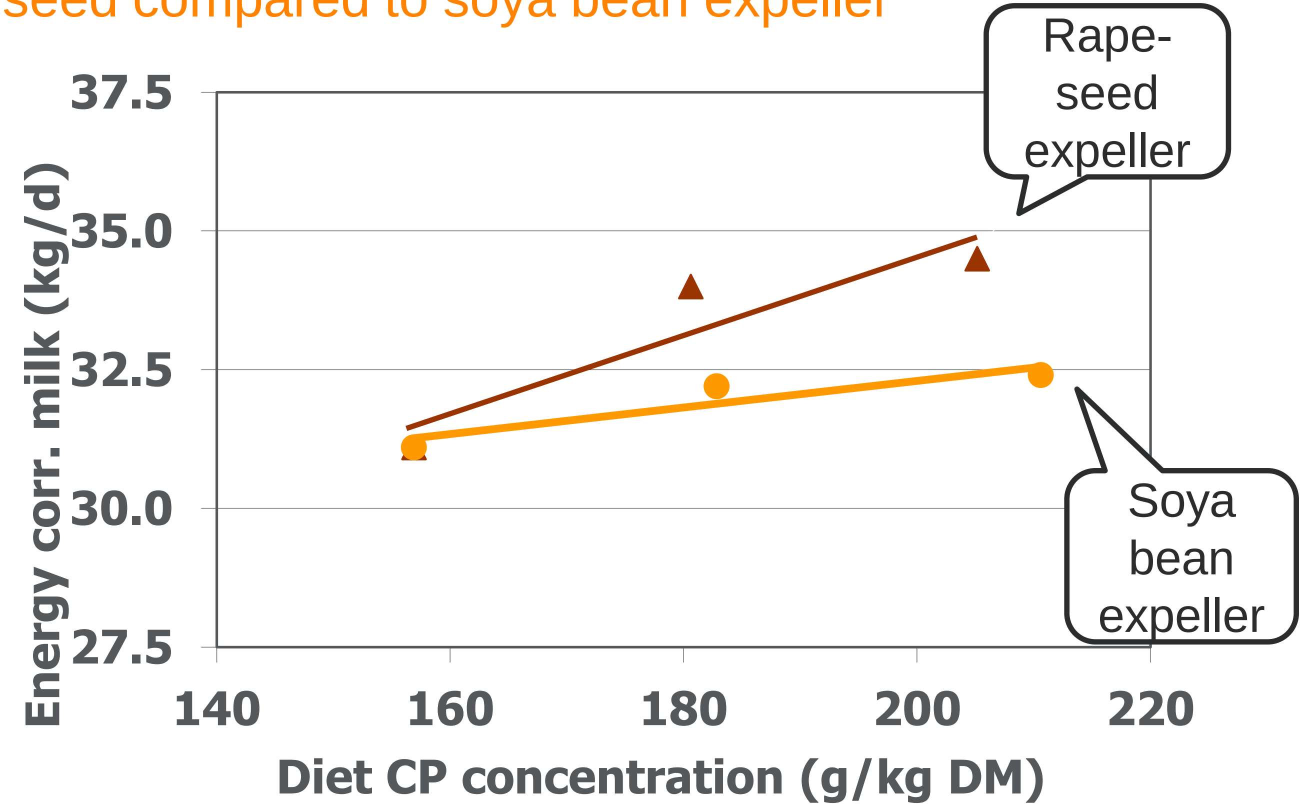
Kuoppala, K., Rinne, M., Nousiainen, J. & Huhtanen, P. 2008. The effect of cutting time of grass silage in primary growth and regrowth and the interactions between silage quality and concentrate level on milk production of dairy cows. Livestock Science 116:171-182.

Protein supplements improve milk production in a similar manner irrespective of basal diet or phase of lactation.



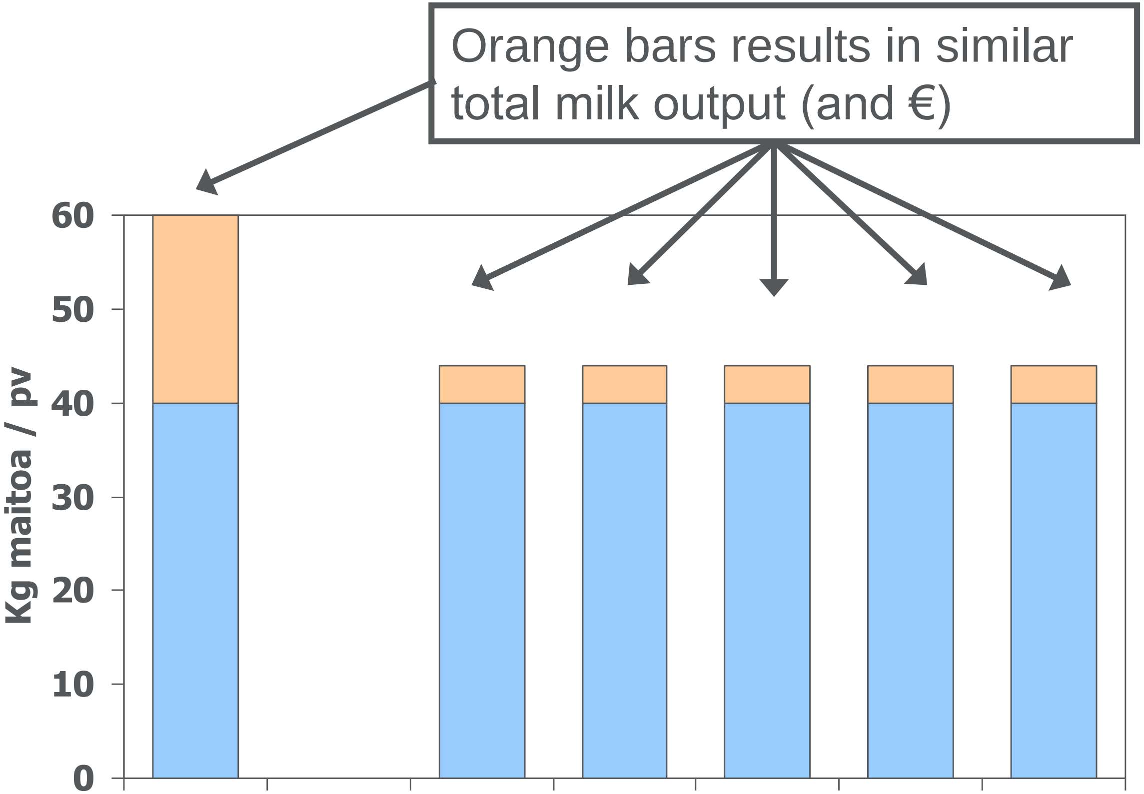
Saarisalo, E., Jaakkola, S. & Huhtanen, P. 1997. Valkuaistäydennyksen vaikutus maidontuotanto-kauden loppuvaiheessa. Kotieläintieteen Päivät 1997. MKL:n julkaisuja no 914, p. 167-169.

Case: Higher milk and protein production responses to rapeseed compared to soya bean expeller



Rinne, M., Kuoppala, K., Ahvenjärvi, S. & Vanhatalo, A. 2015. Dairy cow responses to graded levels of rapeseed and soya bean expeller supplementation on a red clover/grass silage based diet. Animal 9: 1958-1969.

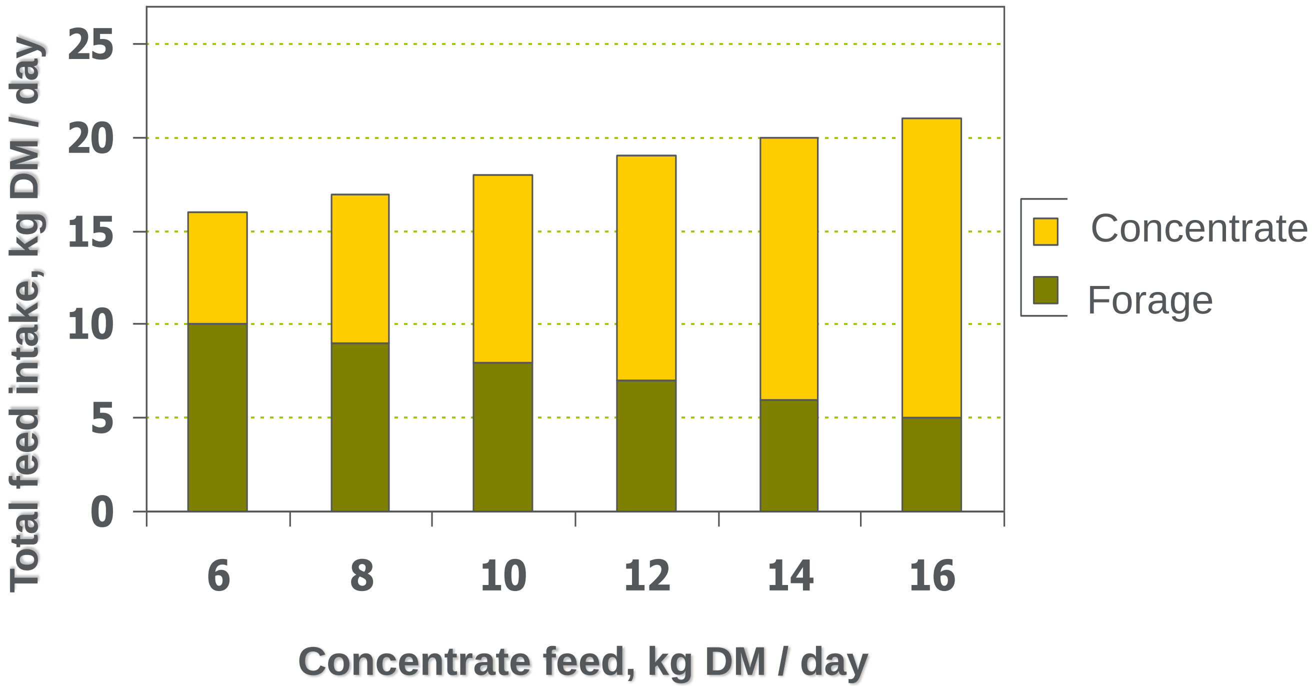
Rather than having individual super high producing cows, it is more important to increase the milk output of the lower yielding cows



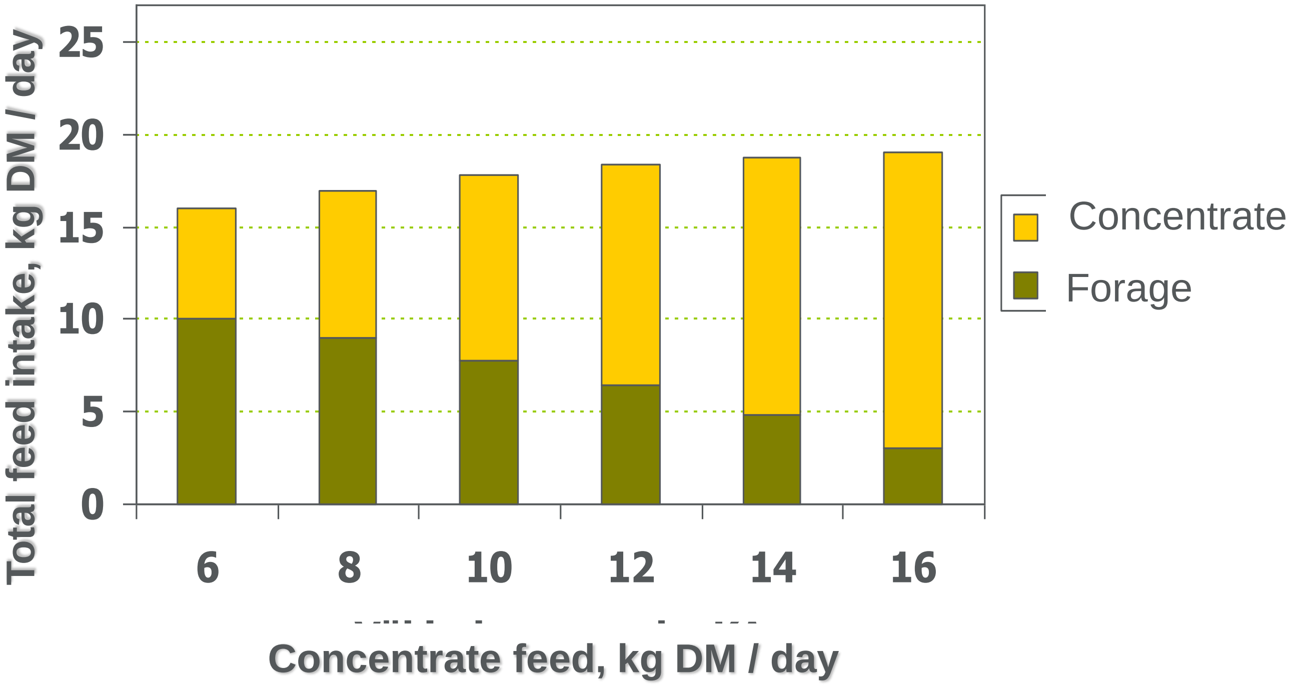
Substitution rate describes, how much voluntary forage intake (in dry matter) declines, when the amount of concentrate (in kg DM) is increased

This figure assumes, all concentrate comes on top pf the forage – this is not happening in real life except in rare conditions!

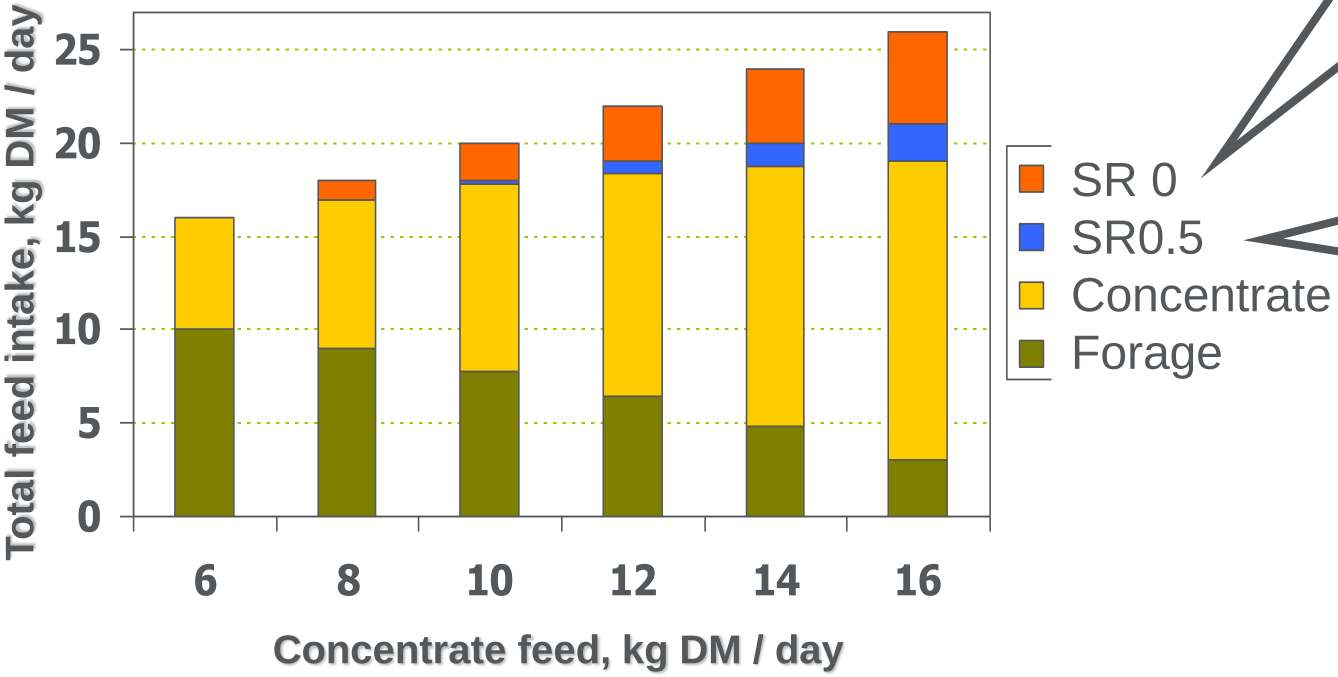
This figure shows a substitution rate of 0.5 – but even this is unrealistic



Here the substitution rate increases the higher the level of concentrate.



Red and blue bars show the potential overestimation of feeds (energy and protein) the cow is getting



SR = 0; Forage intake is not reduced when concentrate is increased

SR constant 0.5 irrespective of amount of concentrate

Overview of production responses – utilizes the flexibility of cows based on the individual on-farm situation – and react to fluctuations in feed availability & costs, as well as milk price!

Increase by one unit	Response
Forage D-value, %	0.5 kg ECM
Concentrate, kg dry matter	
Moderate level	**0.5**-0.6(-0.8) kg ECM
High level	0.1 – 0.2 kg ECM
High quality protein supplement, kg DM (replacing cereal concentrate)	1.2 kg ECM
Substitution rate	0.5 kg DM

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