

# Ruminant production research focus at Natural Resources Institute Finland

1 August 2023

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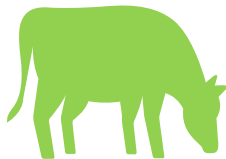
# Cattle play an important role in Finnish food chain and bioeconomy

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



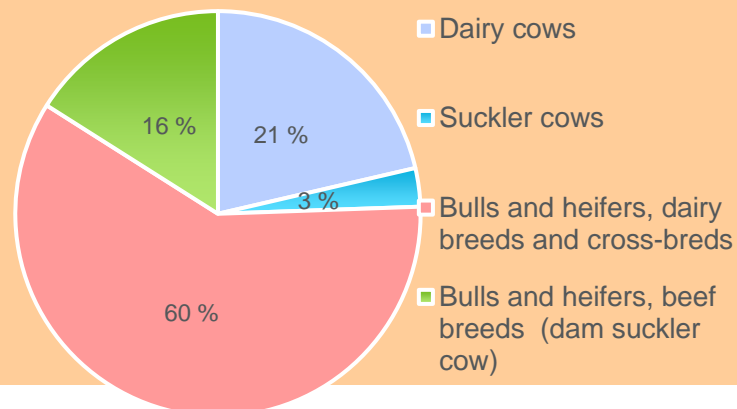
## MILK, MILK PRODUCTS and MEAT

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)



## There is strong debate going on in Finland about the sustainability of animal production

- High carbon footprint of animal products → climate change
- Low nutrient use efficiency → environmental load
- Use of antibiotics → increasing microbial resistance, risk of pandemics
- Loss of biodiversity
- Loss of soil carbon
- Animal welfare
- Healthy diets for people - more vegetables



Photo: Luke/Erkki Oksanen



Perennial forage plant species absorb light efficiently during early season when annual fields are barren

Photos: Luke/Marketta Rinne



Perennial forage plants have large root systems – efficient extraction of water and nutrients and large soil carbon stock

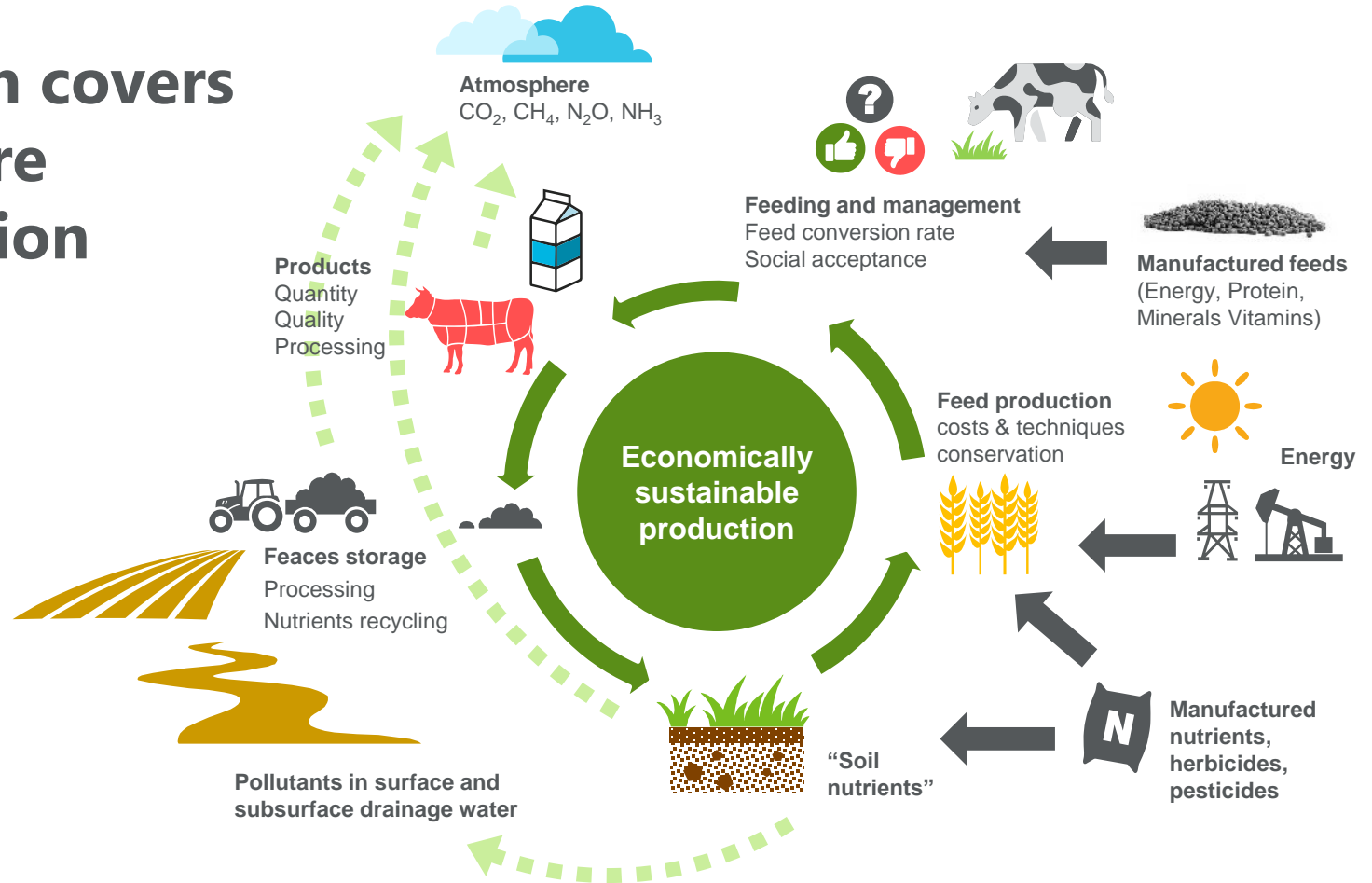


Nitrogen fixing Rhizobium bacteria in legumes

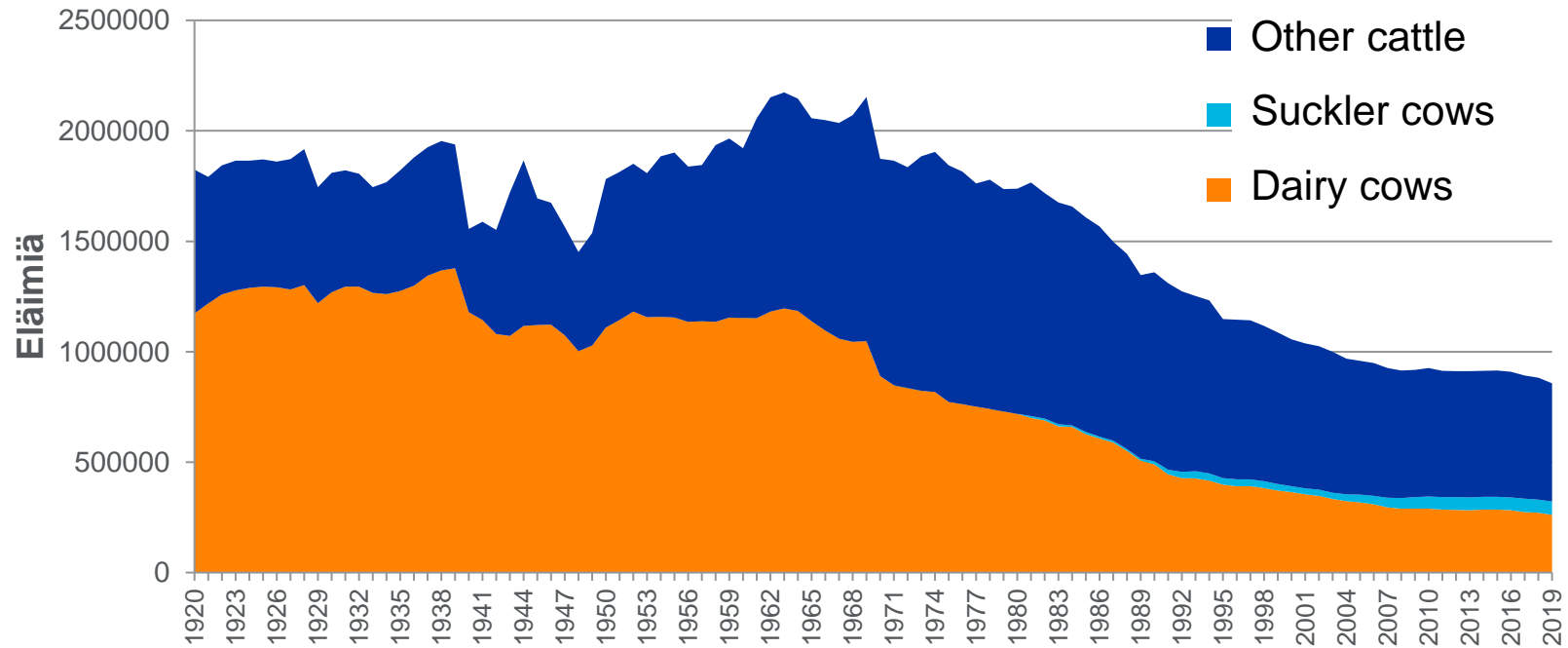
**We need ruminants to convert forages  
into milk and meat**



# Research covers the entire production chain

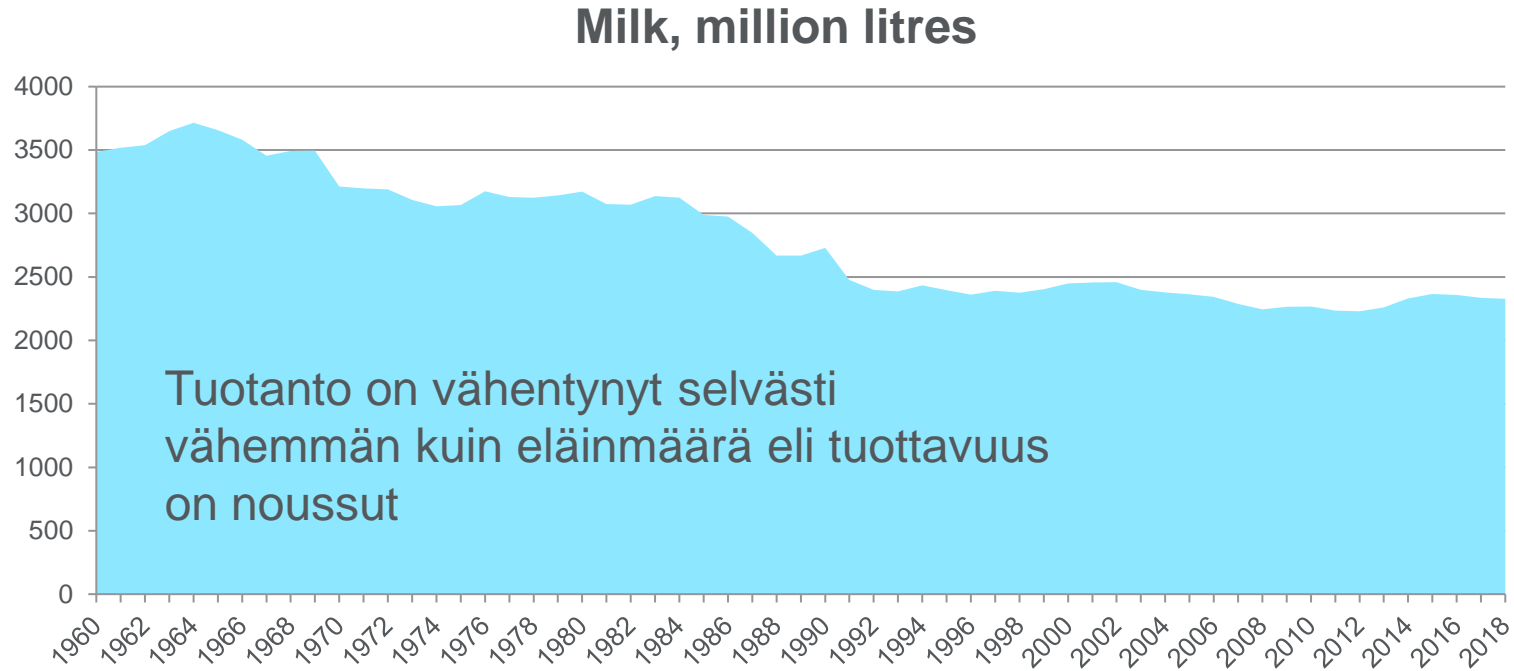


# The numbers of cattle have decreased dramatically in Finland since the 1970's



Source: <https://stat.luke.fi/>

# The amount of milk produced in Finland annually is quite stable





The milk production per cow keeps increasing due to improved genetics, feeding and management

### Mill production (litres per cow per year)

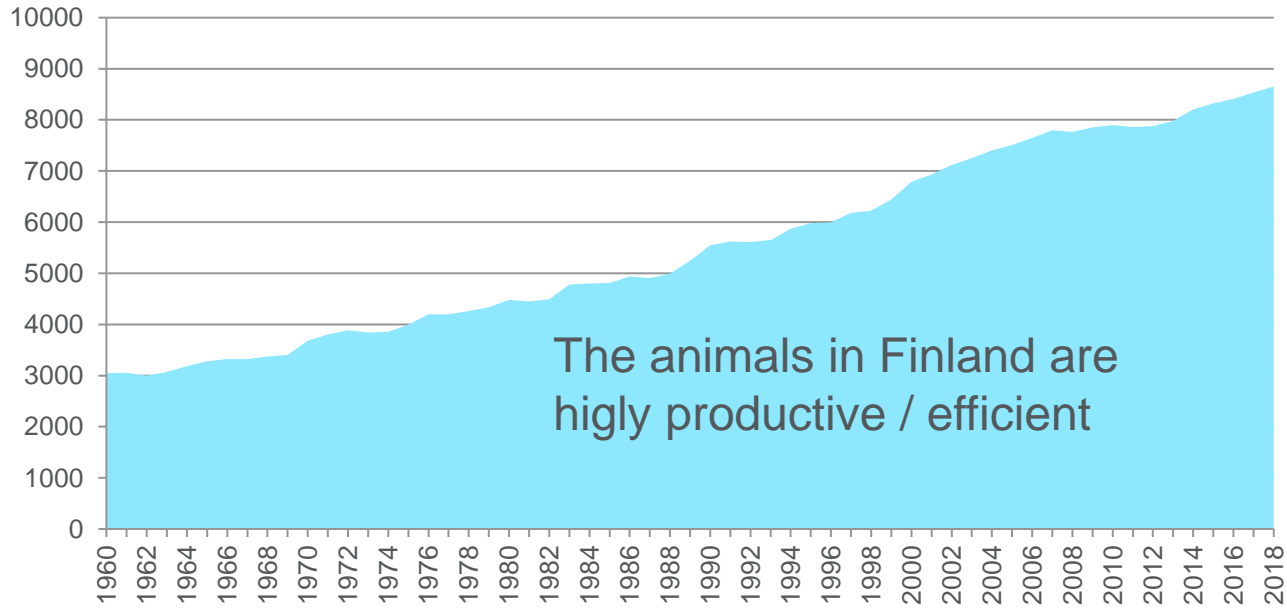


Photo: Marcia Franco / Luke

Source: <https://stat.luke.fi/>

**The climate and soil characteristics set the limits to type of production.**

**Grass plays an important role in arable cropping.**



**Timothy**



**Meadow fescue**



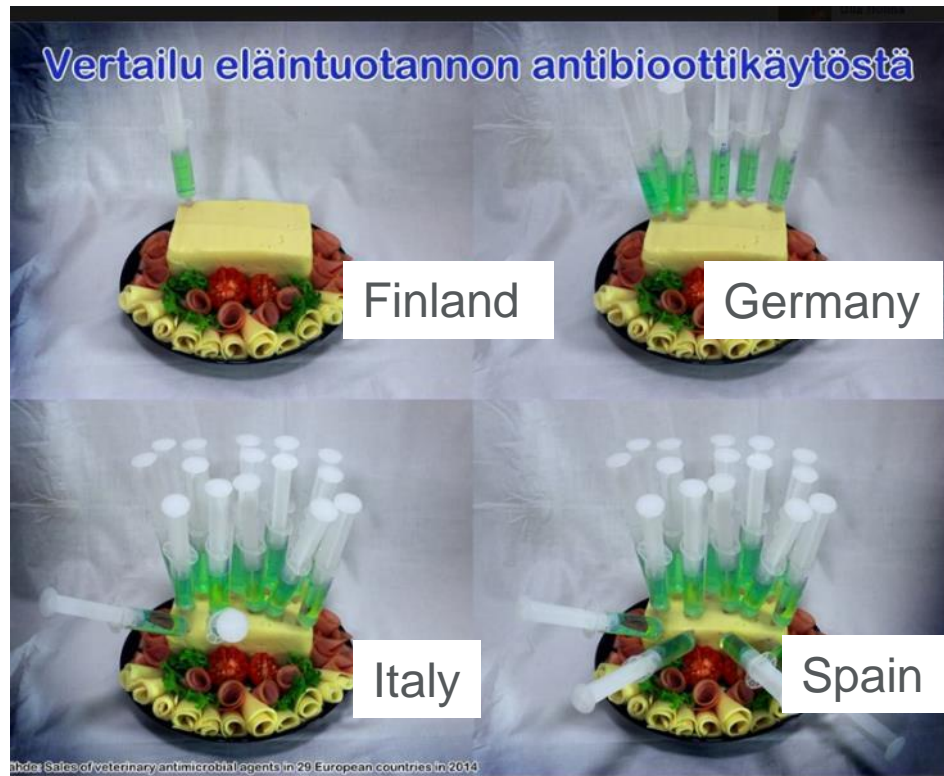
**Red clover**



# National health care programs cover livestock farms

- Naseva for cattle
- Sikava for pigs
- Antibiotics are not used routinely nor for growth promotion, and only based on a prescription by a veterinarian
- Use of hormones is not allowed for growth promotion within EU
- Finland has exceptionally strict protocols to prevent salmonellosis on livestock farms

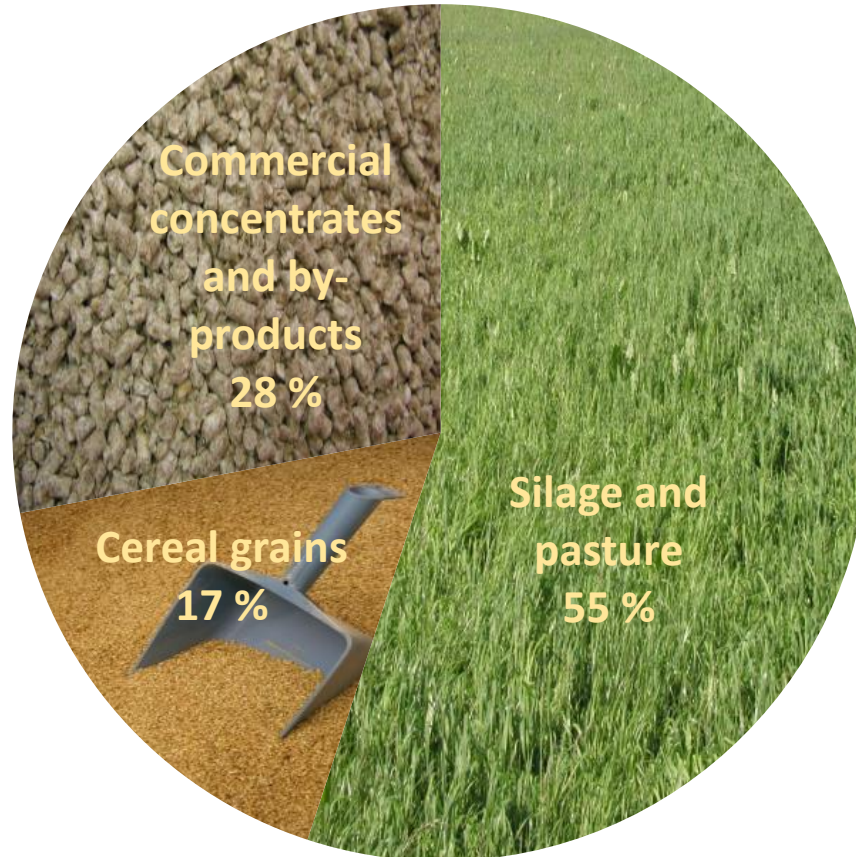
Comparison of antibiotics use  
Source Farmers' Union Etelä-Pohjanmaa



# Dairy cow diet in Finland in 2022

Source: ProAgria

Up to 72 % produced  
on-farm



# Silage is basis of dairy cow feeding in Finland

Received: 4 June 2017 | Revised: 21 August 2017  
DOI: 10.1111/gfs.12327

## REVIEW ARTICLE

WILEY *Grass and Forage Science*

## Highlights of progress in silage conservation and future perspectives

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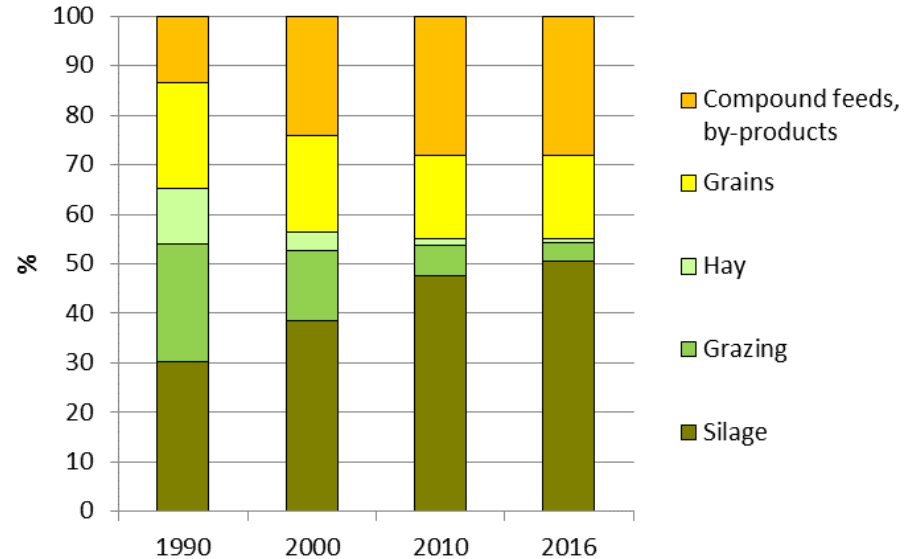
Email: j.mike.wilkinson@gmail.com

### Abstract

Highlights of progress in the production of silage over the past 50 years include the introduction of improved hybrids of maize (*Zea mays* L.), the forage harvester, the big baler, polyethylene covering for horizontal silos, stretch-wrap film for bales and novel additives designed to improve the fermentation and aerobic stability of silage. The key biochemical pathways in the silage fermentation have been described together with the effects of microbial and chemical additives on fermentation and aerobic stability during the feed-out phase. The significance of oxygen and water in silage fermentation has been quantified and efficacy of covering silos has been established, with recent progress in the development of oxygen barrier film. Future perspectives include improving food safety and animal health by increasing the hygienic quality of silage, reducing the environmental impact of silage by decreasing loss of nitrogen to soil and atmosphere, reducing methanogenesis in the rumen and increasing methane yield from silage as biofuel, and the use of silages as feedstocks for multiple end uses in biorefineries.

### KEYWORDS

aerobic stability, biogas, fermentation, inoculant, silage additive



Wilkinson, J. M. & Rinne, M. 2018. Highlights of progress in silage conservation and future perspectives. *Grass and Forage Science*, doi 10.1111/gfs.12327.

Proportions of different types of feeds in dairy cow rations in Finland. Values are presented as net energy for 1990 and 2000 and as DM thereafter (ProAgria, 2017)

# Sustainable Silage activities at Luke Finland

Nisola Ayanfe, Marcia Franco,  
Marketta Rinne

Natural Resources Institute Finland, Jokioinen



# What about more innovative options to provide feed for livestock – or even food for humans?

Many possibilities are already currently biologically and technically feasible, but not economically competitive

The situation may change even quite quickly - crises?

- By-products currently in good use, but new ones keep emerging
- Biorefined grass / other biomasses
  - Seaweeds, micro-algae
    - Single-cell protein
    - Insects, larvae
    - Et cetera...



# Infrastructures are the key to applied dairy research

- Luke has two research dairy barns
- Both barns are surrounded by a farm with versatile feed production options
  - Feed production in Boreal conditions
- Currently plans in place to update the dairy cow facilities





# Research methods at Luke Jokioinen presented in a video:

<https://www.youtube.com/watch?v=1zkQQIj6Lts>

- Farm scale milk and feed production environment
- 120 dairy cows available for feed intake and milk production measurements

There are 129 individual feeding places for cows.

From each feeding place the following records are taken

- daily feed intake
- eating time and duration
- feed intake at each visit at 44 feeding places allowing studies on feeding behaviour



**Focus on individual feed intake**

# Luke is responsible for the official feed evaluation work in Finland. See [www.luke.fi/feedtables](http://www.luke.fi/feedtables)

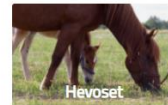
- Energy value for ruminants is calculated from the digestible organic matter content of the feed and presented as metabolizable energy (ME)
- Protein value is described as amino acids absorbed from the small intestine (MP / AAT / OIV) and protein balance in the rumen (PBV / OIV)



*Rehutaulukot -verkkopalvelun päivitys on meneillään!*

## Rehutaulukot

Rehutaulukot ja ruokintasuositukset -verkkopalvelussa (lyh. Rehutaulukot) esitetään viralliset Suomessa käytettävät rehuarvot ja niiden laskentaperusteet sekä ruokintasuositukset märehtijöille, sioille, siipikarjalle, hevosille ja turkiseläimille.





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