



Feed evaluation work in Finland – an overview

Research Professor Marketta Rinne &
Senior Scientist Kaisa Kuoppala

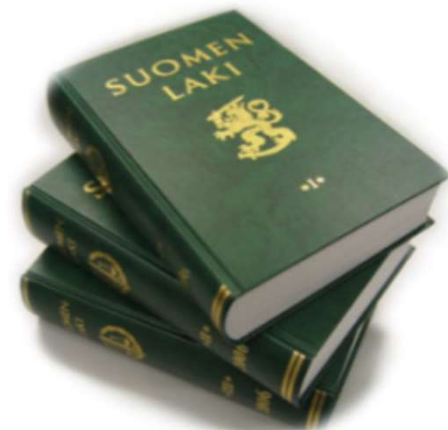
Natural Resources Institute Finland
(Luke)

Feed value webinar 6 March 2024



The mandate of Luke to conduct feed evaluation work is in the national legislation

- Feed law [in Finnish]: 1263/2020
 - The energy and protein values of feed materials and feed mixtures must be based on criteria published by Luke, unless the legislation of European Union states otherwise.
 - The criteria include equations with their default values, the digestibility coefficients published in Feed Tables, and for ruminants, also the effective protein degradability in the rumen



A standing committee for feed evaluation supports the work

- Research Professor Marketta Rinne, pj. (Luke)
- Senior Scientist Kaisa Kuoppala, siht. (Luke)
- University Lecturer Anni Halmemies-Beauchet-Filleau (University of Helsinki)
- Senior Scientist Sini Perttilä (Luke)
- Senior Specialist Tarja Root (Finnish Food Safety Authority)
- Senior Specialist Eeva Saarisalo (Ministry of Agriculture and Forestry)
- Principal Scientist Markku Saastamoinen (Luke)
- Professor Aila Vanhatalo (University of Helsinki)
- Research Scientist Jenni Vattulainen (Luke)

The operative team at Luke:

Marketta Rinne, Kaisa Kuoppala
and Jenni Vattulainen



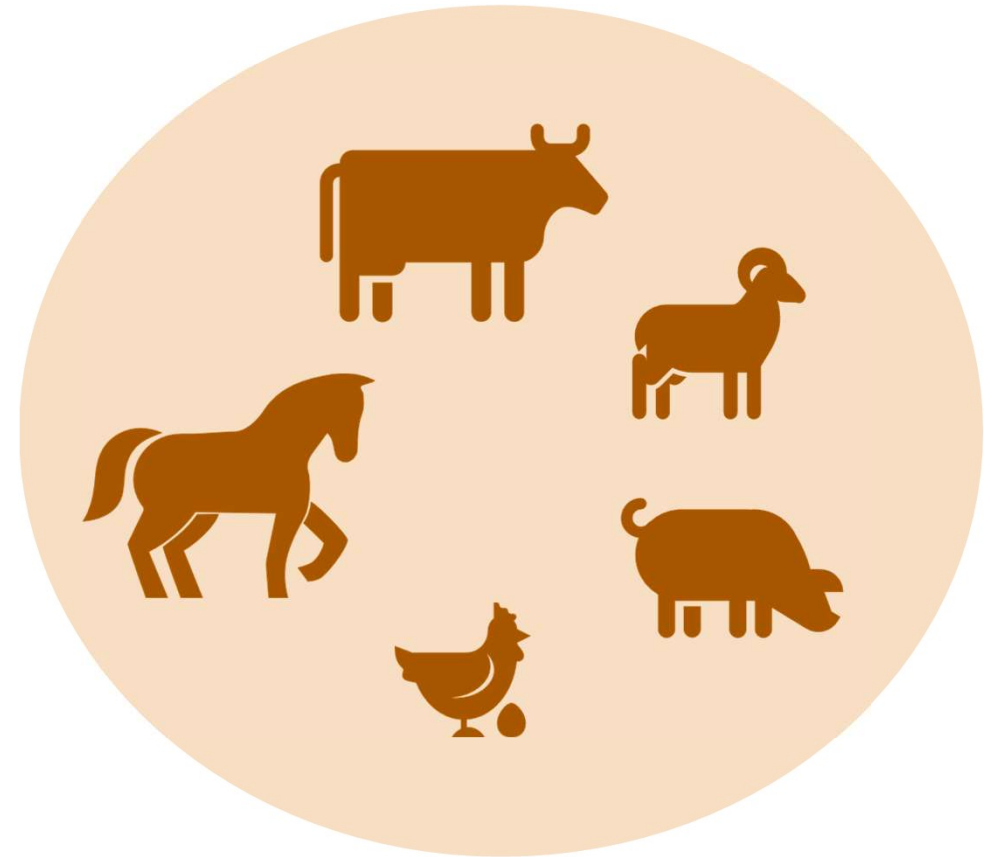
Determining the feed values is the corner stone of systematic animal science and rational practical feeding

- Planning of balanced and cost-effective diets for different animal species and production phases
- Systematic feed evaluation work has started already in 1800's and the systems develop continuously as new information is created
- The central objective of Feed Tables is to present reliable feed values, that describe in the best way the relative differences in terms of their production impact



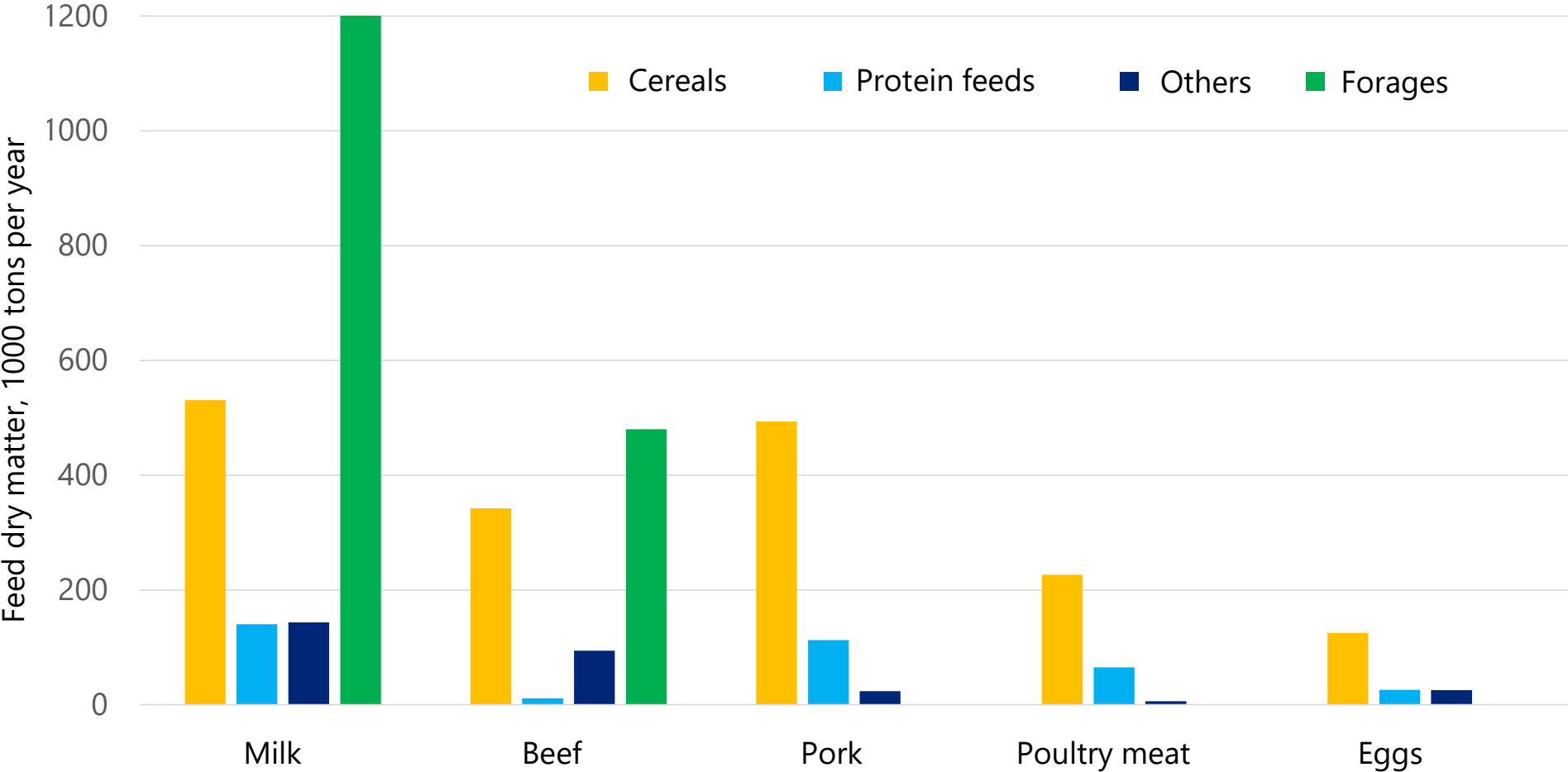
The feed evaluation work covers the most important livestock species

- Cattle (dairy cows, suckler cows, growing cattle)
- Small ruminants (sheep, goats) Hevoset
- Horses
- Pigs
- Poultry (laying hens, broilers, turkeys)



Feed consumption in Finland in different types of livestock production

Marketta Rinne, Nisola Ayanfe, Treform-project



Feed tables and feeding recommendations = feed evaluation system

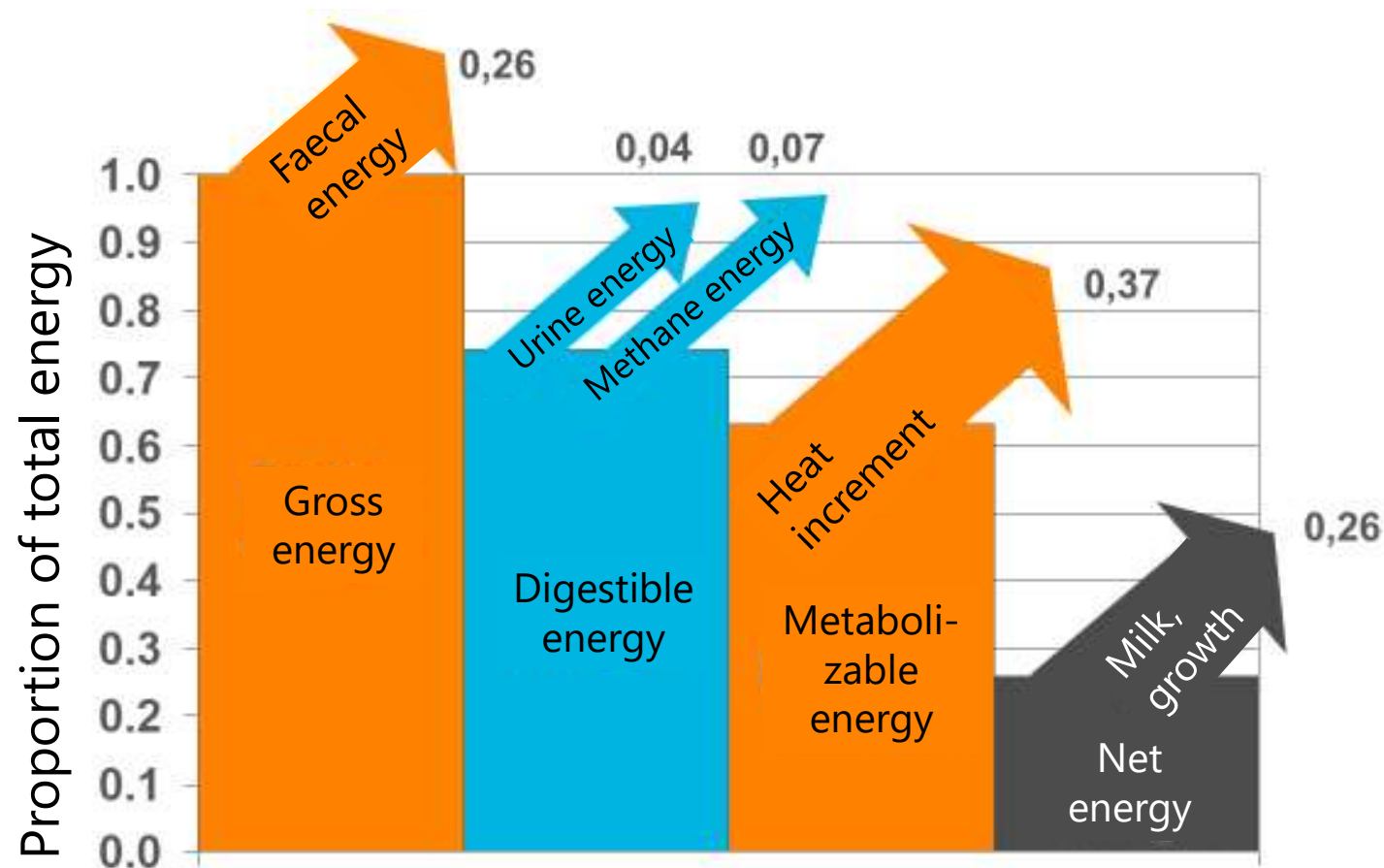
The feed evaluation system contains

1. Equations to calculate the feed values (energy and protein values)
2. Feed values calculated for reference feeds based on their representative composition = Feed Tables
3. Feeding recommendations for different livestock species and phases of production

The feed evaluation system is an entity and parts of it can not be combined with some other system



Different ways of presenting energy take into account the losses at different phases



Kuva: Paula Häyrinen / Luke

Evolution of the ruminant feed evaluation in Finland

- The current metabolizable energy (ME) based system was taken into use in 1995, when it replaced the feed unit originally based on Kellner (1911) net energy for fattening.
 - The unit of ME as megajoules (MJ) was taken into use in 2010
- The roots of the current Finnish AAT-PBV (or metabolizable protein, MP) system are in the joint Nordic development and was taken into use in 1995, when it replaced the system based on digestible crude protein
- The development of feed evaluation systems in Nordic countries has been described in:
 - Weisbjerg, M.R., Rinne, M., Spörndly, R., Ekern, A. and Harstad, O.M. 2010. The history of feed evaluation for ruminants, with special emphasis on the Nordic countries. Proc. 1st Nordic Feed Science Conference, Uppsala, Sweden 23-24 June 2010. pp. 51-64. Available at: https://www.slu.se/globalassets/ew/org/inst/huv/konferenser/nfsc/proceedings/nfsc-2010-proceedings_100617.pdf



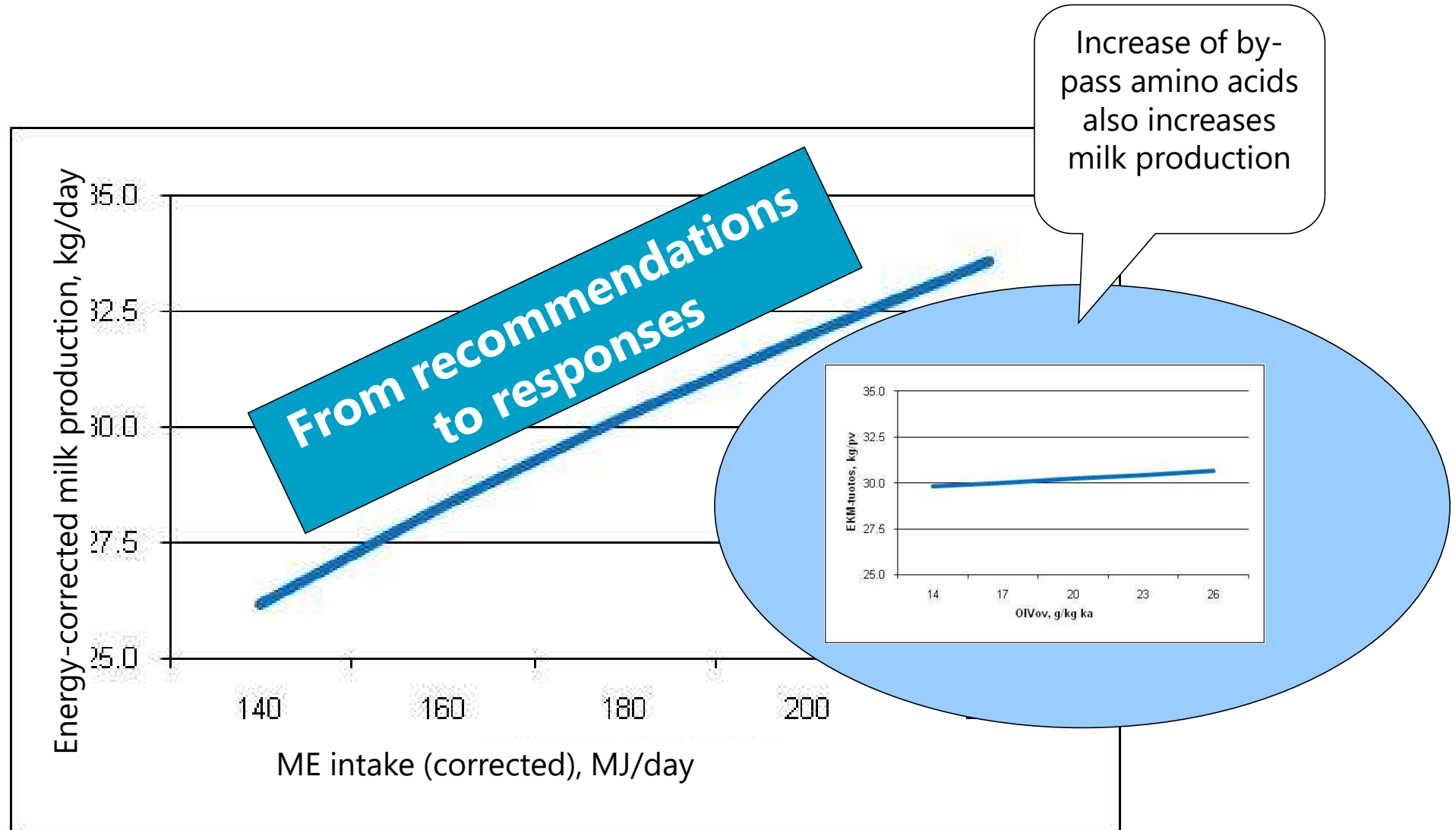
Why do we have an own feed evaluation system in Finland?

- When NorFor system was developed, Finland did not wish to take it into use due to inaccuracies in it
- Finland has a relatively simple (so called factorial) feed evaluation system, where associative effects are taken into account using correction factors
- Complicated systems may in theory describe feed digestion more correctly, but defining all steps and values may be so difficult that the the final output is less accurate
- The feed types used in Finland are quite limited and the environmental conditions exceptional
 - Most common forage plants in Finland timothy and meadow fescue while elsewhere maize, lucerne, ryegrass.
 - Grass grows well and the digestibility is higher in Northern latitudes
 - It is important that feed values are based on local conditions



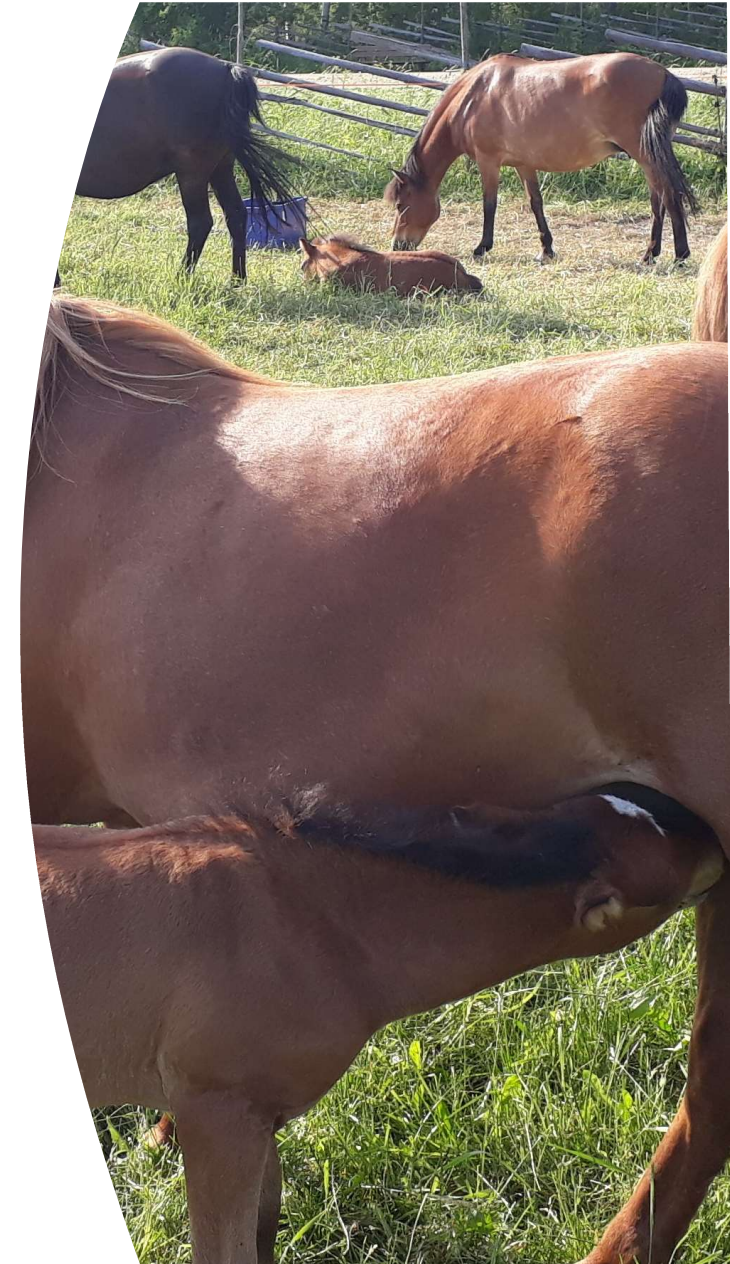
Kuva: Kari Kuoppala / Luke

Energy intake is the single most important factor affecting milk production



Horses

- Energy values are the same as for ruminants (MJ ME/kg ka)
- The digestive system of horses is less efficient than that of ruminants so that horses do not actually get as much energy from the feeds, but this is compensated by the higher feeding recommendations
- Digestible crude protein is used as the protein value
 - Crude protein concentration $\times$ crude protein digestibility



The feed evaluation system of pigs has been the French INRAE / AFZ since 2014

- The energy value is presented as net energy
- Young pigs get less energy from the same feed as older animals, because they do not digest fibre as efficiently
- The protein value is expressed as standardized ileally digested amino acids
- The feed values are calculated using EvaPig® program
- The fast changes in the genetic background of the pigs used and feeding programs linked to contract production
 - >The feeding recommendations presented by Luke are indicative



Poultry

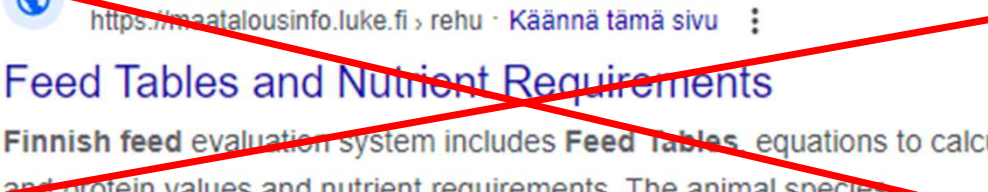
- Energy values of feeds calculated according to common EU definition
 - WPSA 1986. European Table of Energy Values for Poultry Feedstuffs. First edition. Published by subcommittee Energy of the Working Group nr. 2 Nutrition of the European Federation of Branches of the World's Poultry Science Association. Grafisch bedrijf Ponsen & Looijen, Wageningen, the Netherlands. 24 p.
- The concentrations of amino acids are presented in feed dry matter
- Feeding of poultry is conducted according to the contract programs
- The genetic lines used govern the feeding program
- The feeding recommendations presented by Luke are indicative



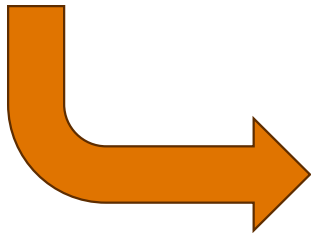
How to find and use Finnish Feed Tables?

Google search "Finnish Feed Tables"

 Maatalousinfo
https://maatalousinfo.luke.fi > rehu · Käännä tämä sivu ⋮
Feed Tables and Nutrient Requirements
Finnish feed evaluation system includes **Feed Tables**, equations to calculate the **feed** energy and protein values and nutrient requirements. The animal species ...



 Luonnonvarakeskus
https://www.luke.fi > finnish-feed-t... · Käännä tämä sivu ⋮
Finnish Feed Tables and Nutrient Requirements
Feed Tables and Nutrient Requirements web site provides official **Finnish Feed Tables**, equations to calculate the feed values and nutrient requirements.



[Luke.fi/feedtables](https://www.luke.fi/feedtables)

Finnish Feed Tables and Nutrient Requirements

Feed Tables and Nutrient Requirements web site provides official Finnish Feed Tables, equations to calculate the feed values and nutrient requirements. The animal species covered include ruminants, pigs, poultry, horses and fur animals.



Web pages

[Luke.fi/feed tables](http://luke.fi/feed-tables)

- [Link to](#) Feed composition and feed value tables
- Dedicated pages for each species
 - How to calculate feed values
 - Feeding recommendations
- Archive etc.

Finnish Feed Tables

Feed Tables list chemical composition, feed values and concentrations of minerals and amino acids of commonly used feed materials, i.e. reference feeds. The values for a feed material vary in different harvests, years and batches. Thus, it is important to analyse the feeds, particularly forages whose composition is more variable than those of concentrate feeds.

[Official Finnish Feed Tables](#)



PAGE
Feed Tables - Ruminants

AGRICULTURE



PAGE
Feed Tables - Pigs

AGRICULTURE



PAGE
Feed Tables - Poultry

AGRICULTURE



PAGE
Feed Tables - Horses

AGRICULTURE



Feed Tables - Ruminants

Agriculture

On this page

- [Energy requirements of dairy cows](#)
- [Protein requirements of dairy cows](#)
- [Nutrient requirements of suckler cows](#)
- [Energy requirements of suckler cows](#)
- [Energy requirements of suckler cows](#)
- [Feeding recommendations of growing cattle](#)
- [Macro and micro mineral and vitamin requirements of cattle](#)
- [Nutrient requirements of sheep and lactating goats](#)

On this page you can find the equations for calculating feed values for ruminant feeds, and feeding recommendations. The Feed Table is a list of typical compositional and feed value data for commonly used feeds, i.e., a list of the so-called reference feeds.

In the planning of feeding of ruminants, Feed Table values may generally be used for common concentrates (e.g. cereal grains). However, the composition of forages vary widely depending on the cultivation, harvesting and preservation techniques applied and prevailing weather conditions. Due to the high proportion of forage in ruminant diets, the analysis of different forage batches used for feeding is of paramount importance.

If the composition of a feed batch has been analysed, feed values can be calculated using the equations described in Basis of calculation and the digestibility coefficients of the reference feed, but using the compositional data of the feed batch concerned in the equations.

[➤](#) [Feed Tables](#)

On this page

● Energy requirements of dairy cows

- Protein requirements of dairy cows
- Nutrient requirements of suckler cows
- Energy requirements of suckler cows
- Energy requirements of suckler cows
- Feeding recommendations of growing cattle
- Macro and micro mineral and vitamin requirements of cattle
- Nutrient requirements of sheep and lactating goats

Energy requirements of dairy cows

Table 1. Requirement of metabolizable energy (ME) of dairy cows, MJ/day.

Maintenance (MJ/d)	Live weight ^{0.75} kg × 0.515 MJ/kg
Milk production (MJ/d)	5.15 MJ/kg DM ECM × ECM, kg/d
Live weight change (MJ/d)	34 MJ × kg live weight gain
	28 MJ × kg live weight loss
Pregnancy (MJ/d)	7 months: 11 MJ/d
	8 months: 19 MJ/d
	9 months: 34 MJ/d

An example of energy requirement for a cow that weighs 650 kg and produces 40 kg energy corrected milk (ECM) per day:

$$\text{Energy requirement (MJ ME/day)} = 650^{0.75} \text{ kg} \times 0.515 \text{ MJ/kg} + 5.15 \text{ MJ/kg ECM} \times 40 \text{ kg ECM/d} = 272 \text{ MJ ME/d}$$

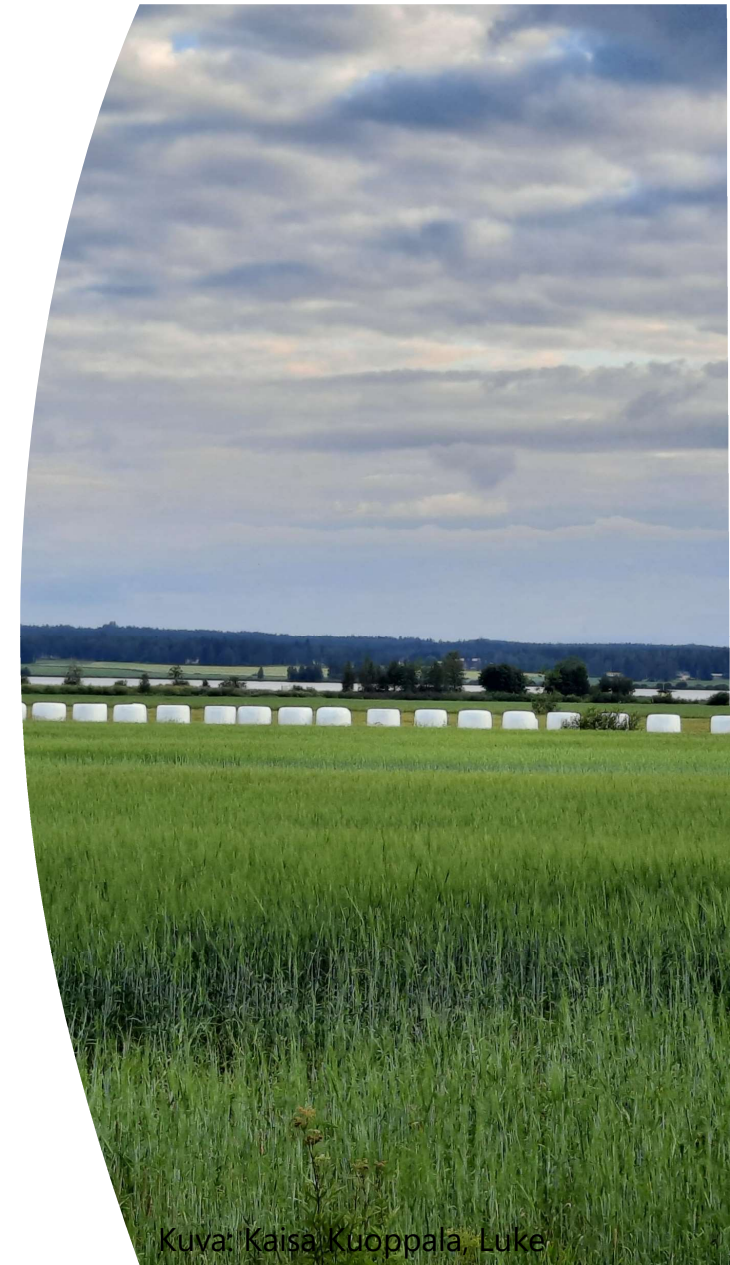
An example of energy requirement for a cow that weighs 550 kg and produces 20 kg energy corrected milk (ECM) per day:

$$\text{Energy requirement (MJ ME/day)} = 550^{0.75} \text{ kg} \times 0.515 \text{ MJ/kg} + 5.15 \text{ MJ/kg ECM} \times 20 \text{ kg ECM/d} = 161 \text{ MJ ME/d}$$

Feed Tables

- 280 feeds
 - ruminants 239, pigs 125, poultry 134
 - Amino acids 72, minerals 201
- Every feed has a number (category + feed)
- Chemical composition of a feed is common to all animal groups:
 - Dry matter, crude protein, crude fat, crude fibre, ash
 - NDF, starch, sugar
- Each animal group has own figures:
 - For example D value, EPD for ruminants, ileal digestible amino acids
 - Digestibility coefficients and constants, equations

➡ Own feed energy- and protein values for each animal group



Kuva: Kaisa Kuoppala, Luke

Feed tables

Link to this page in
luke.fi/feedtables



Database for Research Results

Deutsch
Suomi
Svenska

[Home](#) / [Agriculture](#) / Feed Tables

Agriculture



Choose table



Choose variable



Show result

Search in Agriculture:

Search

⊖ Agriculture

⊕ Biomass

⊖ Feed Tables

Ruminants  

Pigs  

Poultry  

Horses  

Fur animals  

Minerals  

Amino acids  

⊕ Food databank



Choose table



Choose variable



Show result

Ruminants

Choose variables

▼ About table

Expert view

Feed Mandatory*

▼ Select classification ---

☒ Select all ☐ Deselect all

→ Go to: Select values from group

Search ☐ Beginning of word

Selected 0 of total 238

1000 Barley, over 69 kg/ha
1001 Barley, 64 - 69 kg/ha
1002 Barley, 60 - 64 kg/ha
1003 Barley, 57 - 60 kg/ha
1004 Barley, under 57 kg/ha
1005 Barley, naked

Feed data Mandatory*

☒ Select all ☐ Deselect all

Search ☐ Beginning of word

Selected 0 of total 20

DM, g/kg
ME, MJ/kg DM
MP, g/kg DM
PBV, g/kg DM
EPD
D value, g/kg DM

^ --- Select classification ---

— Select classification —

All feeds

- 1 Grains and seeds
- 2 Cakes and meals
- 3 Plant by-products
- 4 Feeds of animal origin
- 5 Roots, tubers, fruits and cabbages
- 6 Fresh forages and pasture
- 7 Grass silages
- 8 Other silages
- 9 Hay and artificially dried grasses
- 10 Straw
- 11 Minerals
- 90 Other feeds

Show

Number of rows
(maximum number allowed is 100,000)

Presentation on screen is limited to 10,000 rows and 100 columns

▼ Footnotes

Choose table

Choose **Feed:**

Choose classification

Choose all

Choose single feeds

Search

Choose **Feed data:**

Choose all

Choose single feeds

Search

Abbreviations in Footnotes



Choose table



Choose variable



Show result

Ruminants

Choose variables

▼ About table

Expert view

Feed Mandatory*

▼ Select classification ▼

☒ Select all ☐ Deselect all

→ Go to: Select values from group

Search

☐ Beginning of word

Selected 0 of total 238

1000 Barley, over 69 kg/ha
1001 Barley, 64 - 69 kg/ha
1002 Barley, 60 - 64 kg/ha
1003 Barley, 57 - 60 kg/ha
1004 Barley, under 57 kg/ha
1005 Barley, naked

Feed data Mandatory*

☒ Select all ☐ Deselect all

Search

☐ Beginning of word

Selected 0 of total 20

DM, g/kg
ME, MJ/kg DM
MP, g/kg DM
PBV, g/kg DM
EPD
D value, g/kg DM

Show table

Number of selected rows: 0
(Maximum number allowed is 100,000)

Display on screen is limited to 10,000 rows and 100 columns

▼ Footnotes

Choose table

Choose **Feed**:

Choose classification

Choose all

Choose single feeds

Search

Choose **Feed data**:

Choose all

Choose single feeds

Search

Abbreviations in Footnotes



Choose table



Choose variable



Show result

Ruminants

Result

✓ About table

✓ Show result as...

✓ Edit and Calculate

✓ Save result as...

✓ Save your query

✓ Hide empty rows

	DM g/kg	ME, MJ/kg DM	MP, g/kg DM	PBV, g/kg DM	EPD	D value, g/kg DM	CP, g/kg DM	EE, g/kg DM	CF, g/kg DM	NFE, g/kg DM	NDF, g/kg DM	INDF, g/kg DM	Sta, g/kg DM	Sug, g/kg DM	Ash, g/kg DM	CPd, g/g	EE g/
1000 Barley, over 69 kg/hl	860	13.2	96	-31	0.80	822	113	22	46	790	210	37	620	20	29	0.66	0.64
1001 Barley, 64 - 69 kg/hl	860	13.2	96	-29	0.80	821	115	22	48	786	210	37	610	20	29	0.67	0.64
1002 Barley, 60 - 64 kg/hl	860	13.1	96	-25	0.80	817	119	22	54	776	210	37	600	20	29	0.68	0.64
1003 Barley, 57 - 60 kg/hl	860	12.9	95	-20	0.80	801	122	22	56	771	230	39	595	20	29	0.69	0.64
1004 Barley, under 57 kg/hl	860	12.5	94	-13	0.80	777	127	22	58	764	230	39	585	20	29	0.70	0.64
1005 Barley, naked	860	13.8	104	-5	0.80	849	150	28	36	761	123	37	700	30	25	0.74	0.7
1011 Oats, over 58 kg/hl	860	12.4	93	-12	0.75	729	125	60	103	674	280	110	460	18	38	0.71	0.6
1012 Oats, 54 - 58 kg/hl	860	12.1	92	-8	0.75	711	127	60	109	666	290	115	440	18	38	0.70	0.6
1013 Oats, 45 - 54	860	11.5	89	0	0.75	677	130	60	124	650	310	125	420	18	36	0.68	0.6

Show result as
charts
Save result as
excel

Feed tables for ruminants by Feed and Feed data

	DM g/kg	ME, MJ/kg DM	MP, g/kg DM	PBV, g/kg DM	EPD	D value, g/kg DM	CP, g/kg DM	EE, g/kg DM	CF, g/kg DM	NFE, g/kg DM	NDF, g/kg DM	INDF, g/kg DM	Sta, g/kg DM	Sug, g/kg DM	Ash, g/kg DM	CPd, g/g	EEd, g/g	CFd, g/g	NFEd, g/g	OMd, g/g
1000 Barley, over 69 kg/hl	860	13.2	96	-31	0.80	822	113	22	46	790	210	37	620	20	29	0.66	0.64	0.30	0.91	0.85
1001 Barley, 64 - 69 kg/hl	860	13.2	96	-29	0.80	821	115	22	48	786	210	37	610	20	29	0.67	0.64	0.30	0.91	0.85
1002 Barley, 60 - 64 kg/hl	860	13.1	96	-25	0.80	817	119	22	54	776	210	37	600	20	29	0.68	0.64	0.30	0.91	0.84
1003 Barley, 57 - 60 kg/hl	860	12.9	95	-20	0.80	801	122	22	56	771	230	39	595	20	29	0.69	0.64	0.30	0.89	0.83
1004 Barley, under 57 kg/hl	860	12.5	94	-13	0.80	777	127	22	58	764	230	39	585	20	29	0.70	0.64	0.30	0.86	0.80

How to refer to Feed Tables

In text: Luke 2024

In References:

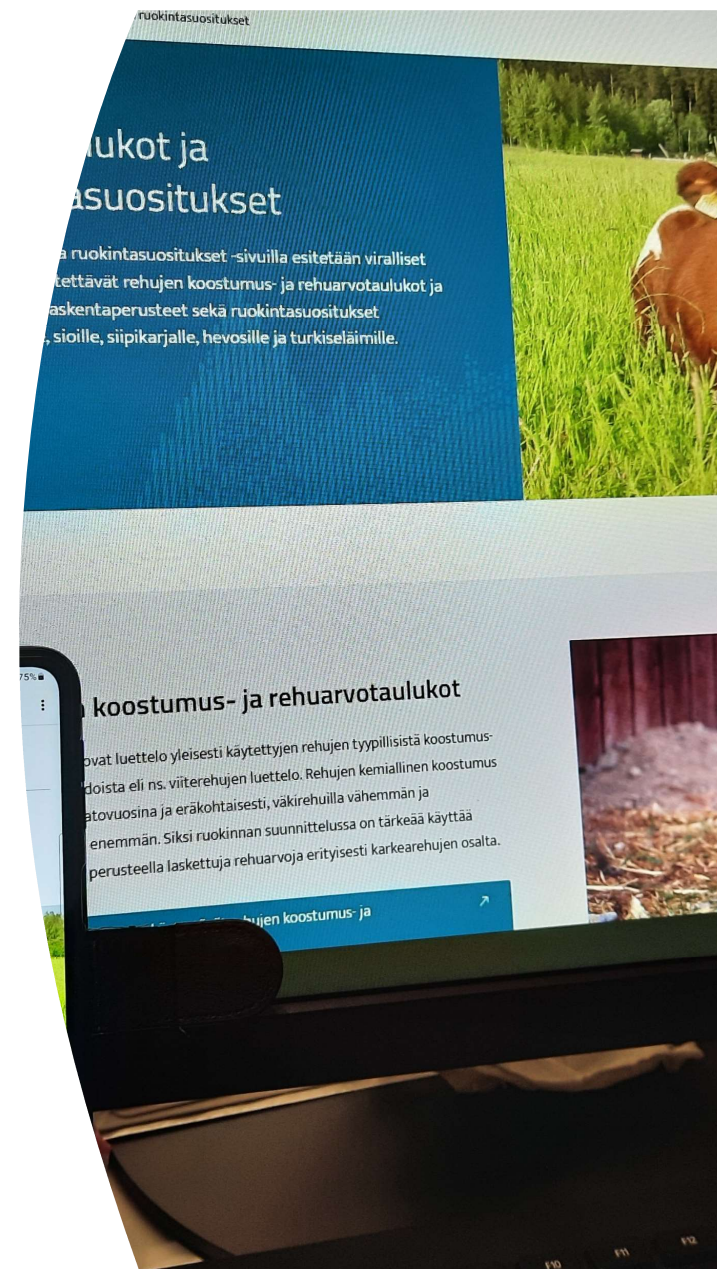
- Luke 2024. Finnish Feed Tables and Nutrient Requirements [web publication]. Helsinki: Natural Resources Institute Finland [referred 6.3.2024]. Available: <https://www.luke.fi/feedtables>

The final form of the reference depends on the media to which you submit your paper!

Important:

Use short address [luke.fi/feedtables](https://www.luke.fi/feedtables) in references, not the long address which is seen in the address line!

The short address remains the same even if the interface of the feed tables changes



Finnish feed tables ja feeding recommendations –publication in Finnish

- Natural Resources and Bioeconomy Studies 17/2024
- A link to the publication will be added to the website
- The previous 2015 publication has been downloaded for more than 20 000 times!
- English version is coming out this year!



Luonnonvara- ja biotalouden tutkimus 17/2024

Rehutilukot ja ruokintasuositukset

Märehtijät, siat, siipikarja, hevoset

Kaisa Kuoppala, Jenni Vattulainen, Sini Perttilä,
Markku Saastamoinen ja Marketta Rinne

Feed values are used for many purposes

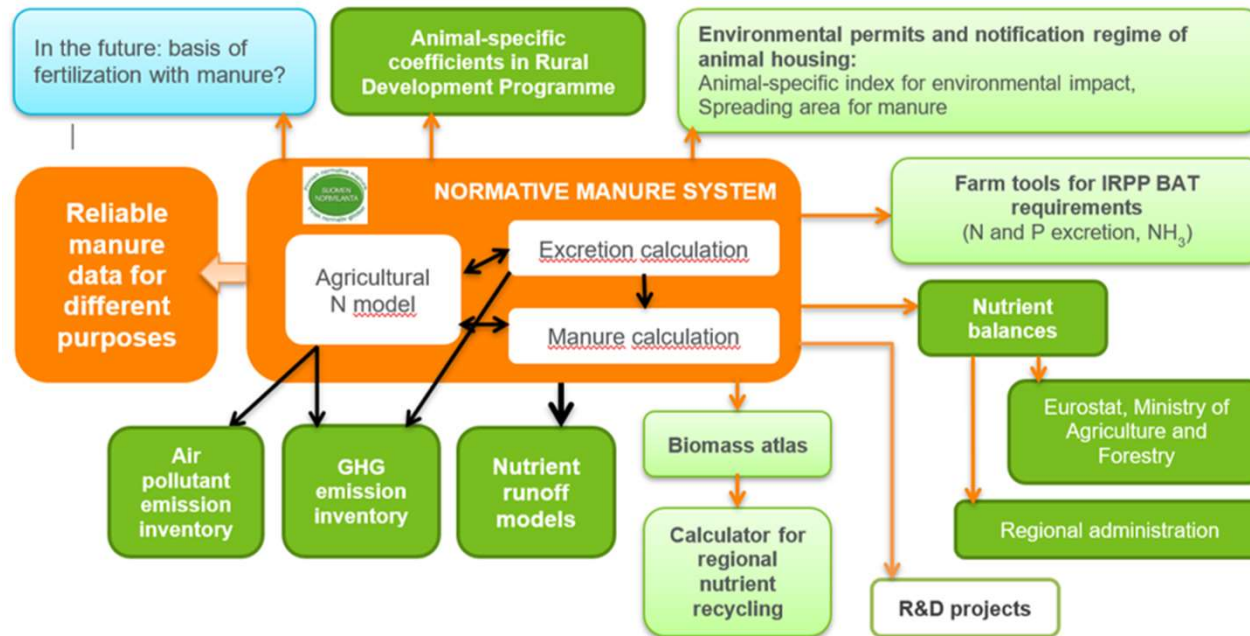
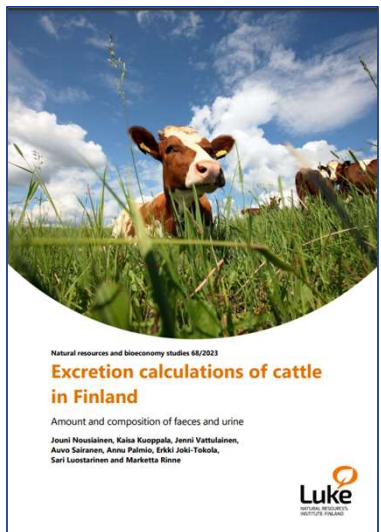
- Pricing of feeds
- Planning and optimization of diets for livestock
- The composition / nutritional value / safety (vitamins, trace elements)
- The carbon foot print of feeds and subsequently animal products
 - A need for commonly accepted calculation methods
- Utilization of nutrients(N, P)
- Default values for different reserach and modelling activities, scenarios, excretion calculations etc.



Future perspectives regarding feed evaluation work in Finland

- At present, the need to update the feed value systems (energy and protein values) is probably not very acute
- However, in the long term, the maintenance and development of the systems is needed
- Development activities need to be projected and externally funded (Luke policy)
- As part of the statutory service status, we maintain the service and provide guidance to users
- Skilled staff is needed for feed evaluation work
- Global trends need to be followed
- Maintenance and updating of the feed materials list in the feed tables is an ongoing activity
 - Data is generated as part of various projects not necessarily directly related to feed value work
- In case of research needs of customers, cooperation can be conducted in publically funded projects, PPP-projects (public-private-partnership) or as commissioned contract research

Feed value info is part of the bioeconomy in a wide sense



An example of systems related to livestock manure



Luke.fi/rehutaulukot

Luke.fi/fodertabeller

Luke.fi/feedtables

Feedback address: rehutaulukot@luke.fi



Kuva: Kaisa Kuoppala, Luke

You can find us online

 luke.fi

Subscribe to our newsletter to stay informed!
luke.fi/newsletter



Natural Resources Institute Finland (Luke)
Latokartanonkaari 9, FI-00790 Helsinki

