'Compound feed costs for dairy cattle affected by local sourcing'

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Content

- Trends related to feed sourcing
- How to increase self sufficiency for feed
- Simulation study on effects of local sourcing on compound feed costs
- Local sourcing and sustainability
- Take home messages

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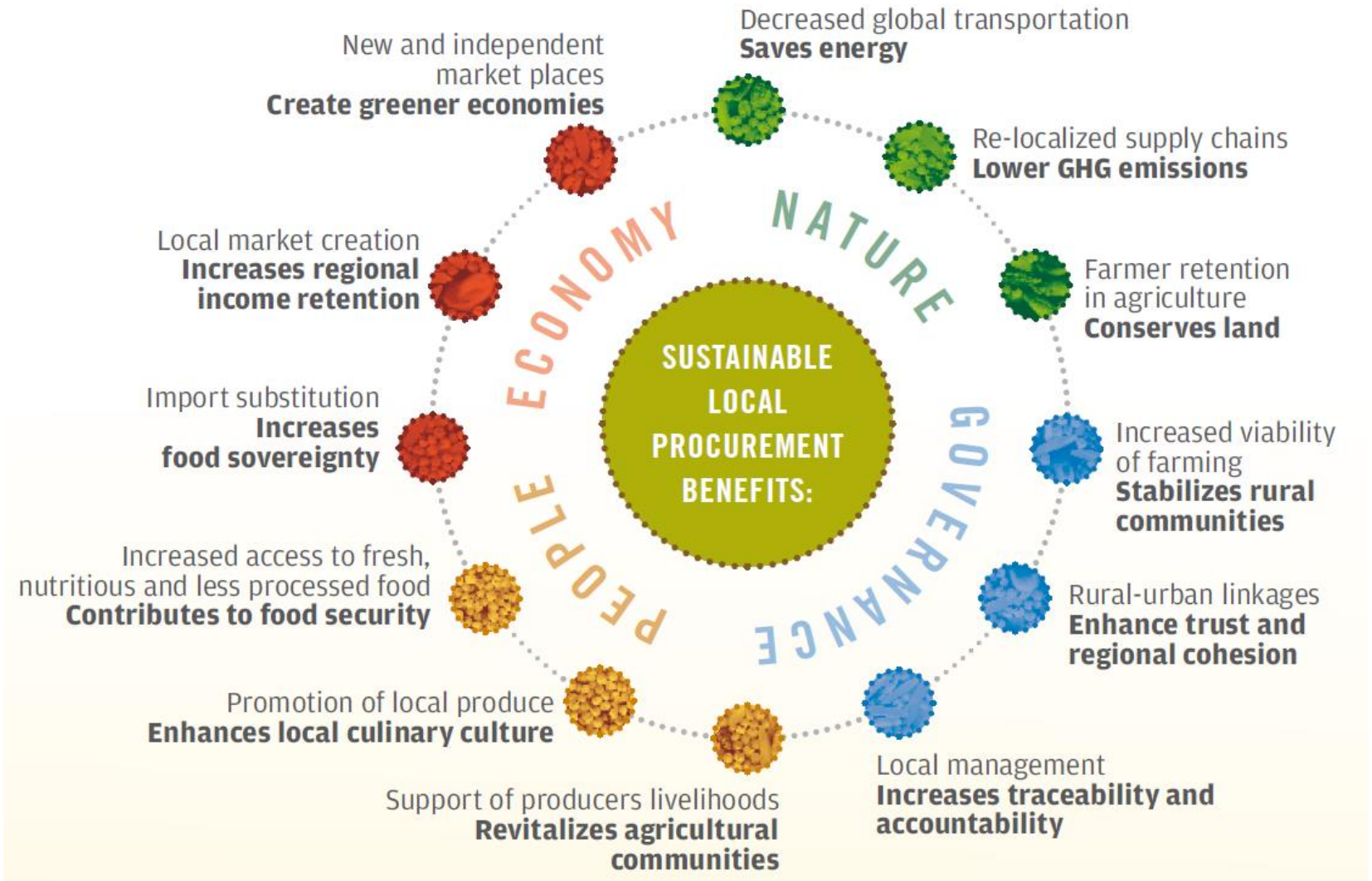
Trends

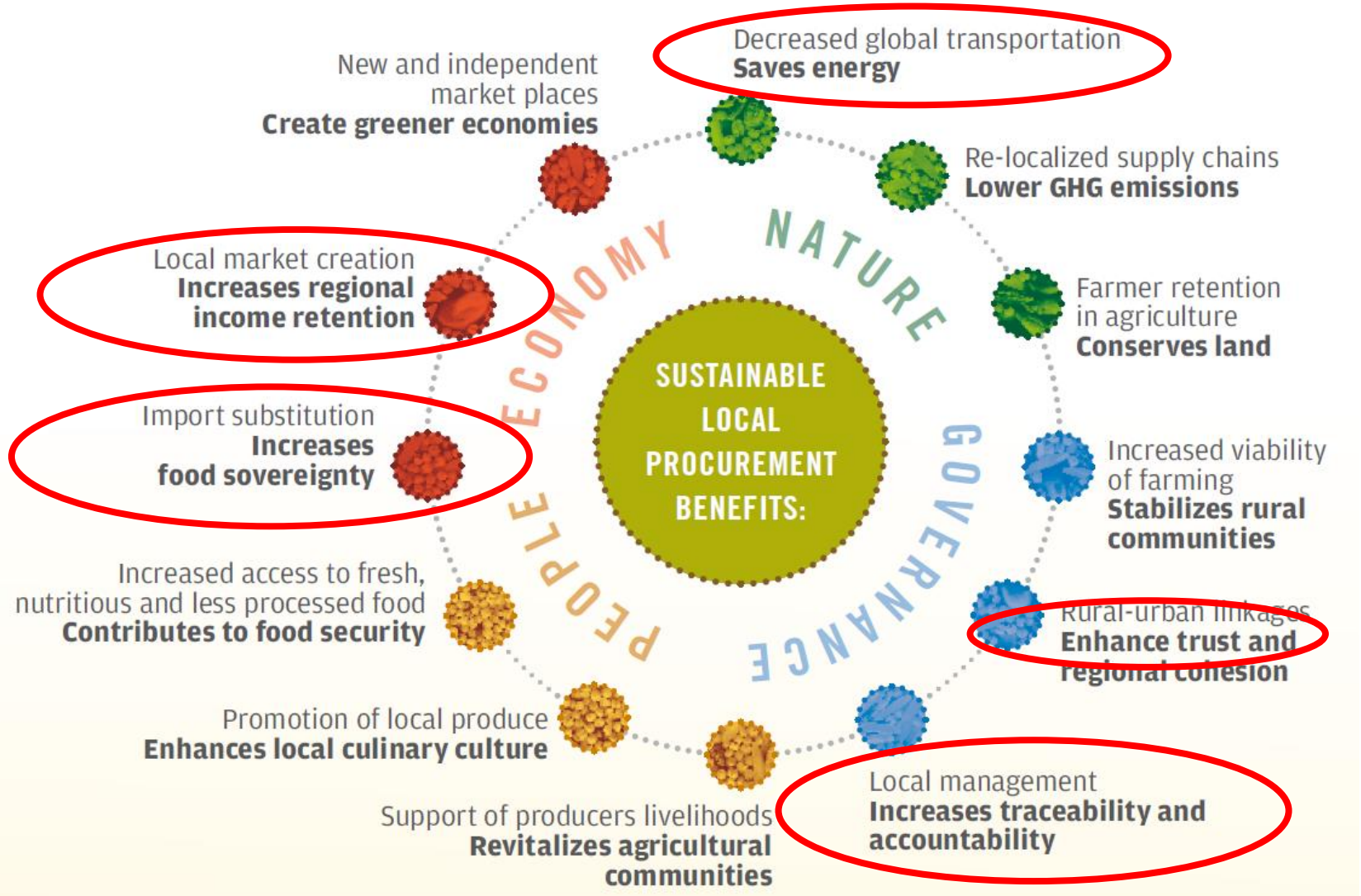
- Sustainable sourcing is becoming main stream in society
- EU policy to reduce imports of protein rich feed materials
- Self-sufficiency for feed materials promoted
  - *By EU, farmers organisations, dairy industry, NGO's, ...*
- Circularity: (re)use of co-products and residuals
- Novel (local) feed materials
  - *Novel proteins*
  - *Fractionation of biomass by bio refinery*
- Increasing demand for GMO free food chains

Sustainable local procurement



Source: FAO

Sustainable local procurement



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Reduction of non-EU protein imports

- **European Parliament** (Resolution 2011): concerns because of too much dependency from Latin-America
  - Import soy products 2014: 33 million tonnes
  - Increasing soy demand China: 70 million tonnes
  - EU self sufficiency protein rich feed materials 30%

- **NGO's**: Concerns because of deforestation of tropical rain forest, loss of biodiversity, soil and water pollution, negative impact on small farmers and native population

- **Societal debate:** GMO versus non-GMO (soybean) crops

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Self-sufficiency: case of the Netherlands

- April 2018: farmers organisation (LTO) and dairy association (NZO) introduced vision document on land-based dairy production and self-sufficiency

- Targets
  - 65% self-sufficiency for protein at farm level in 2025
  - Grassland as key element
  - Closing nutrient cycles at local level
  - Reduction of non-EU protein rich feed materials with 2/3rd (2025 vs 2018)

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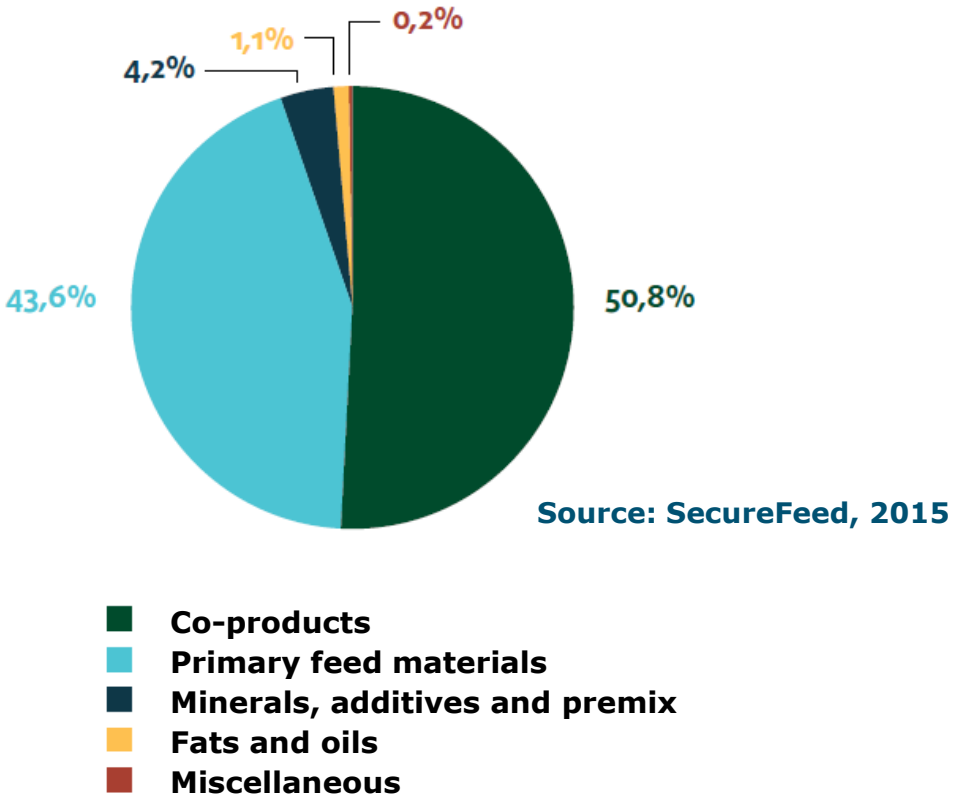
Co-products in Dutch feed sector

- Over 300 different raw feed materials
- Total volume of raw materials for compound feed and single feedstuffs: 19 million tons/year
  - Includes 51% co-products & residuals (Nevedi, 2016)



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Novel feed materials

- Aquatic proteins
- Insects for feed (not for ruminants)
- New protein and energy crops
- Single cell proteins
- Biomass components from bio refinery
    - Refinery of grass and green leafs

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Factors limiting the use of novel feed resources in feed formulation

- Nutritional aspects
  - variability in nutrient level and quality
  - presence of naturally occurring anti-nutritional and/or toxic factors
  - presence of pathogenic micro-organisms
  - need for supplementation
- Technical aspects
  - seasonal and unreliable supply (need for storage)
  - bulkiness, wetness and/or powdery texture
  - processing requirements
  - lack of research and development efforts

Source: Ravindran & Blair, 1991

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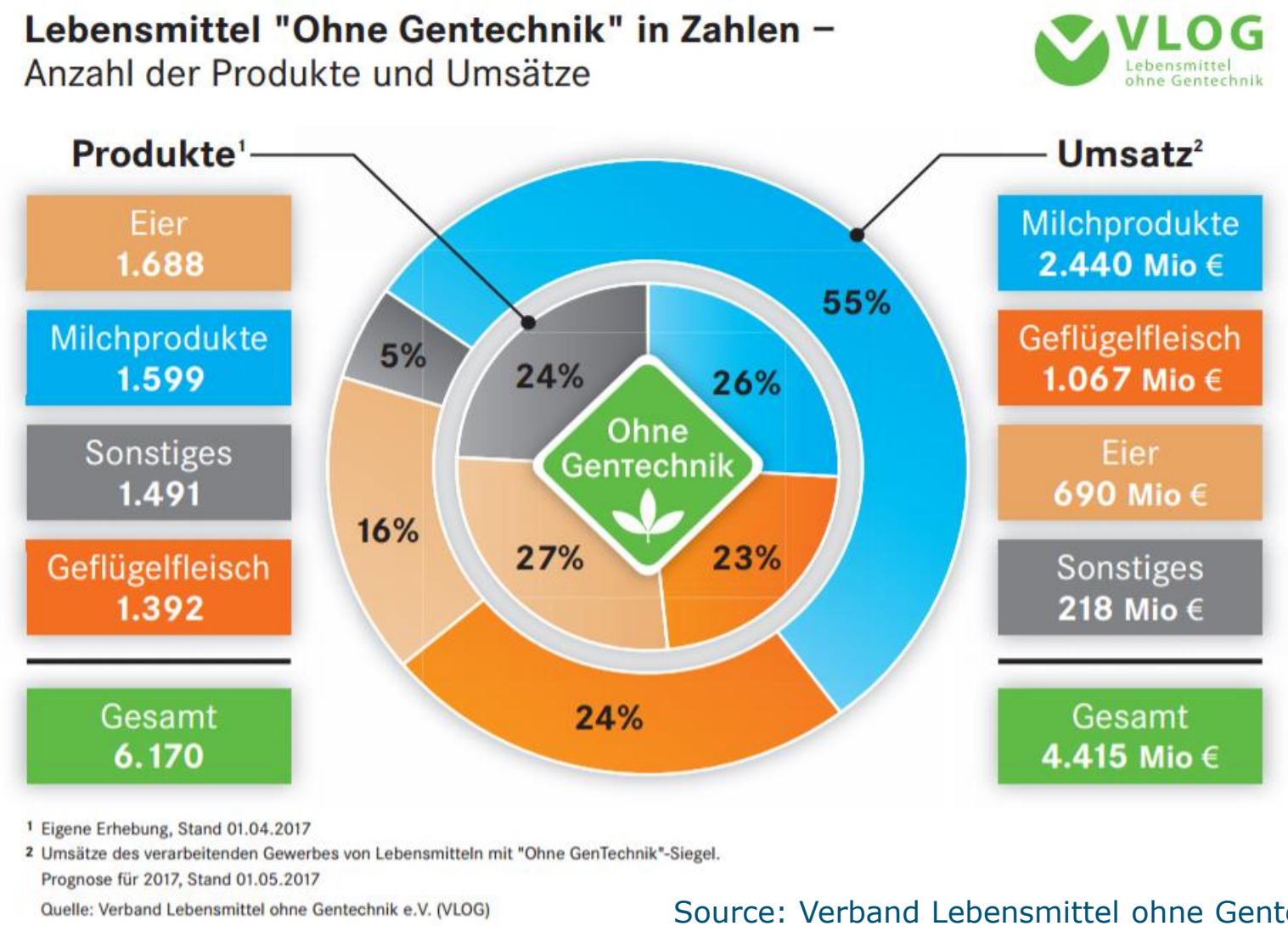
GMO-free food products in Germany



Source: Verband Lebensmittel ohne Gentechnik e.V. (VLOG, 2017)

How to increase self sufficiency for feed

Scenario's to reduce feed material imports

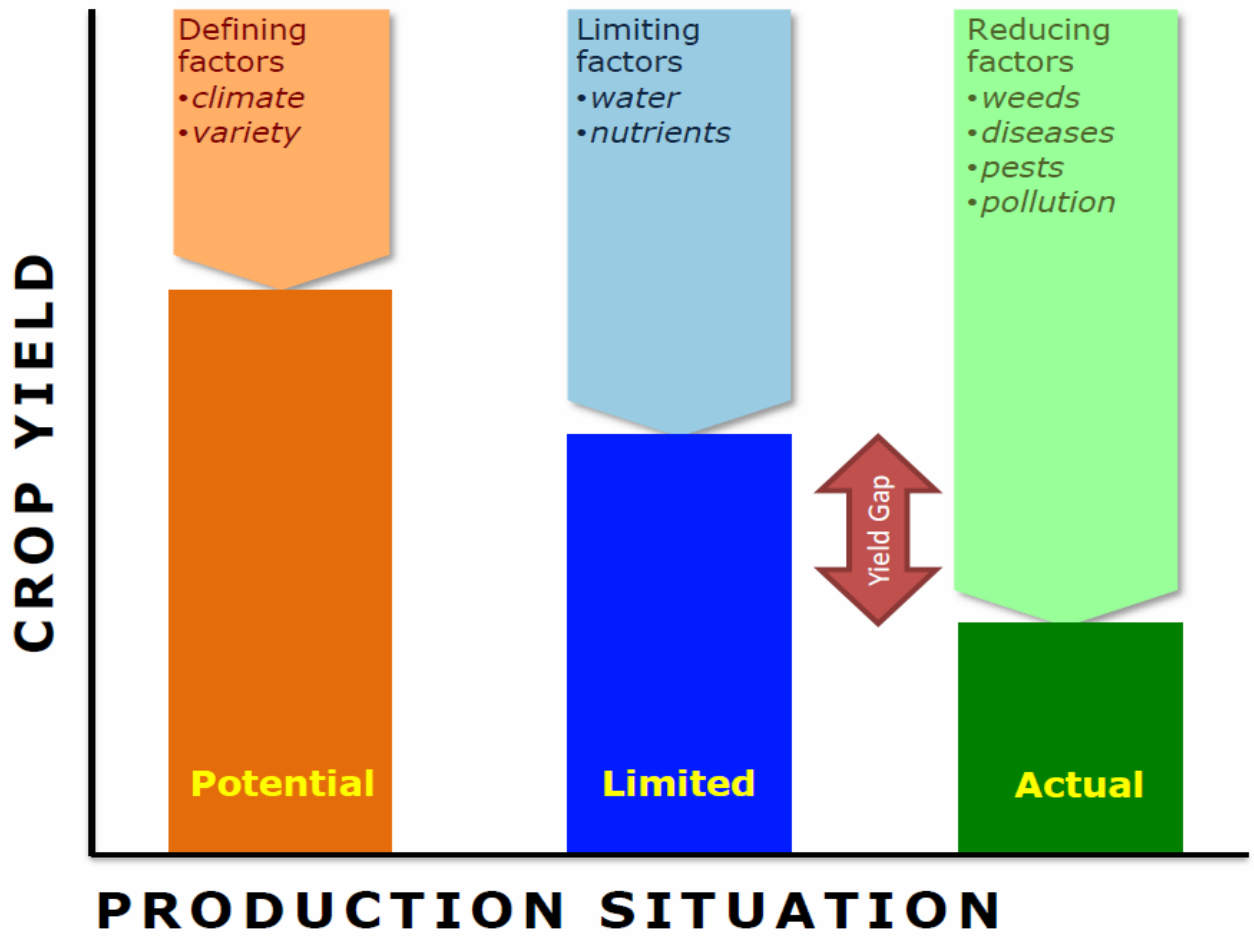
1. Improving home grown feed production and utilisation
   - Reducing yield gaps in grass and forage production
   - Improve harvest management, silage and conservation management
   - Improve feed and nutrient use efficiency by animal

   → In general: increased farm profitability

2. Local sourcing of feed materials for purchased feed

   → In general: increased feed costs

Theoretical crop production and yield gaps



H. Lövenstein, GFFCx-MOOC, 2015

Losses on field, during ensiling and feed-out

Total losses (as % of dry matter) under good and poor management practices

		Management Practice	
		Good	Poor
Field losses (%)	Cutting	1.2	2.0
	Tedding	2.4	6.4
	Windrowing and loading	1.7	3.4
	Respiration	0.0	2.0
	Microbial deterioration	0.0	2.0
	Leaching	0.0	3.0
	Total field losses	5.3	18.8
Ensiling, storage losses (%)	Silage fermentation	3.0	10.0
	Effluent losses	0.0	2.0
	Preservation losses	1.2	2.4
	Total ensiling losses	4.2	14.4
Feed-out, feeding losses (%)	Feed out and feeding losses	3.0	7.0
	Heating	0.0	6.5
	Total feed-out losses	3.0	13.5

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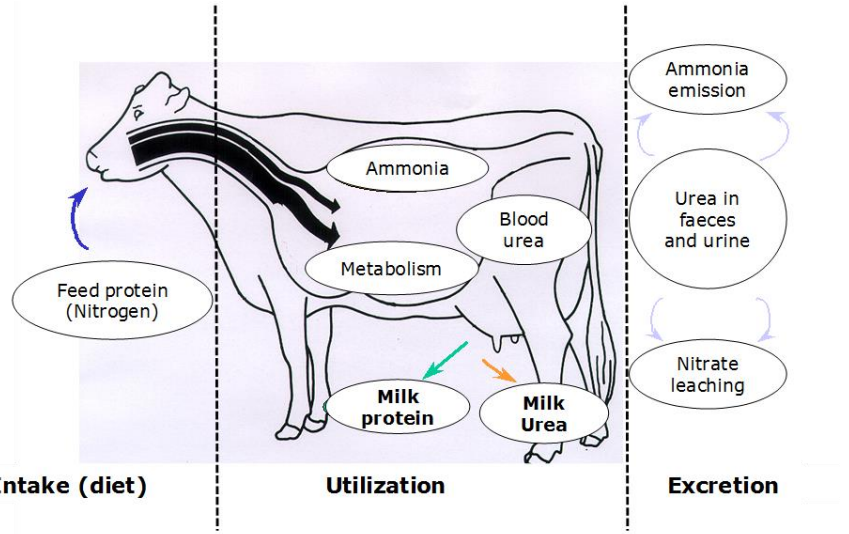
Source: Van Schooten and Philipsen (2010)

Nutrient use efficiency by animal

- Feeding according requirements
- Longevity, animal health and wellbeing
- Precision feeding
  - Taking into account individual and temporal variation
- Use of biomarkers and management tools



Simulation study on effects of local sourcing on compound feed costs

Simulation study using least cost formulation

- 3 compound feeds: standard, medium, high protein
  - 90, 120, 180 g MP*/kg, respectively
- 3 scenarios:
  - Business as usual, full availability of raw materials
  - Exclusion of non-EU soybean products
  - Only local (European) feed materials
- Compound feed costs compared for these 3 x 3 = 9 cases
- Ingredient prices: average of monthly prices in 2017
  - € /100 kg; delivered to feed company; excl. VAT

* MP = Metabolisable Protein, according to Dutch DVE system

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Compound feed composition (%), low protein

Scenario	No restrictions	No non-EU soy products	No non-EU materials
Chalk	1.35	1.35	1.52
DDGS maize	1.94	1.94	5.00
Magnesium oxide	0.01	0.01	
Maize	30.00	30.00	30.00
Maize gluten feed. CP<200 g/kg			16.93
Molasses beet. sugar>475 g/kg	3.00	3.00	3.00
Palm kernel expeller. CF<180 g/kg	15.00	15.00	
Premix	0.75	0.75	0.75
Rape seed meal. CP<380 g/kg	15.00	15.00	15.00
Rape seed meal. formaldehyde treated			0.75
Salt	0.32	0.32	0.19
Triticale	10.09	10.09	13.13
Vinasses beet. CP <250 g/kg	4.00	4.00	3.74
Wheat gluten feed	10.00	10.00	10.00
Wheat middlings	8.53	8.53	

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In low protein compound feeds...

- ...no raw materials had to be replaced in the scenario without non-EU soy products
- ...15% of the raw materials had to be replaced in the scenario without non-EU materials

Compound feed composition (%), medium protein

Scenario	No restrictions	No non-EU soy products	No non-EU materials
Chalk	1.38	1.52	1.72
DDGS maize	5.00	5.00	5.00
Linseed			1.89
Maize	28.72	30.00	30.00
Maize gluten feed. CP<200 g/kg			16.52
Maize gluten meal			0.54
Molasses beet. sugar>475 g/kg	3.00	3.00	3.00
Palm kernel expeller. CF<180 g/kg	15.00	15.00	
Premix	0.75	0.75	0.75
Rape seed meal. CP<380 g/kg	20.00	6.70	5.00
Rape seed meal. formaldehyde treated		13.30	15.00
Salt	0.30	0.39	0.33
Soybean meal. formaldehyde treated	7.78		
Sunflower seed meal. CF<160. CP 380 g/kg		9.80	10.00
Triticale		3.70	8.25
Vinasses beet. CP <250 g/kg	4.00	2.00	2.00
Wheat gluten feed	10.00	8.84	
Wheat middlings	4.06		

Compound feed composition (%), medium protein

Scenario	No restrictions	No non-EU soy products	No non-EU materials
Chalk	1.38	1.52	1.72
DDGS maize	5.00	5.00	5.00
Linseed			1.89
Maize	28.72	30.00	30.00
Maize gluten feed. CP<200 g/kg			16.52
Maize gluten meal			0.54
Molasses beet. sugar>475 g/kg	3.00	3.00	3.00
Palm kernel expeller. CF<180 g/kg	15.00	15.00	
Premix	0.75	0.75	0.75
Rape seed meal. CP<380 g/kg	20.00	6.70	5.00
Rape seed meal. formaldehyde treated		13.30	15.00
Salt	0.30	0.39	0.33
Soybean meal. formaldehyde treated	7.78		
Sunflower seed meal. CF<160. CP 380 g/kg		9.80	10.00
Triticale		3.70	8.25
Vinasses beet. CP <250 g/kg	4.00	2.00	2.00
Wheat gluten feed	10.00	8.84	
Wheat middlings	4.06		

In medium protein compound feeds...

- ...8% of the raw materials had to be replaced in the scenario without non-EU soy products
- ...23% of the raw materials had to be replaced in the scenario without non-EU materials

Compound feed composition (%), high protein

Scenario	No restrictions	No non-EU soy products	No non-EU materials
Chalk	1.61	1.76	1.83
DDGS maize	5.00	5.00	5.00
Linseed			0.98
Magnesium oxide	0.10	0.10	0.14
Maize	13.67	13.92	26.92
Maize gluten feed. CP<200 g/kg		9.27	6.09
Maize gluten meal		15.72	16.99
Molasses beet. sugar>475 g/kg	3.00	3.00	3.00
Palm kernel expeller. CF<180 g/kg	15.00	15.00	
Premix	0.75	0.75	0.75
Rape seed meal. CP<380 g/kg	16.72	5.00	5.00
Rape seed meal. formaldehyde treated	3.28	15.00	15.00
Salt	0.85	0.77	0.79
Soybean meal. CF 50-70. CP<450 g/kg	21.21		
Soybean meal. formaldehyde treated	15.00		
Sunflower seed meal. CF 200-240. CP 310 g/kg		2.21	5.00
Sunflower seed meal. CF<160. CP 380 g/kg	1.82	10.00	10.00
Triticale			0.17
Urea		0.50	0.34
Vinasses beet. CP <250 g/kg	2.00	2.00	2.00

Compound feed composition (%), high protein

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Chalk	1.61	1.76	1.83
DDGS maize	5.00	5.00	5.00
Linseed			0.98
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Sunflower seed meal. CF 200-240. CP 310 g/kg		2.21	5.00
Sunflower seed meal. CF<160. CP 380 g/kg	1.82	10.00	10.00
Triticale			0.17
Urea		0.50	0.34
Vinasses beet. CP <250 g/kg	2.00	2.00	2.00

In high protein compound feeds...

- ...36% of the raw materials had to be replaced in the scenario without non-EU soy products
- ...51% of the raw materials had to be replaced in the scenario without non-EU materials

Compound feeds costs per scenario

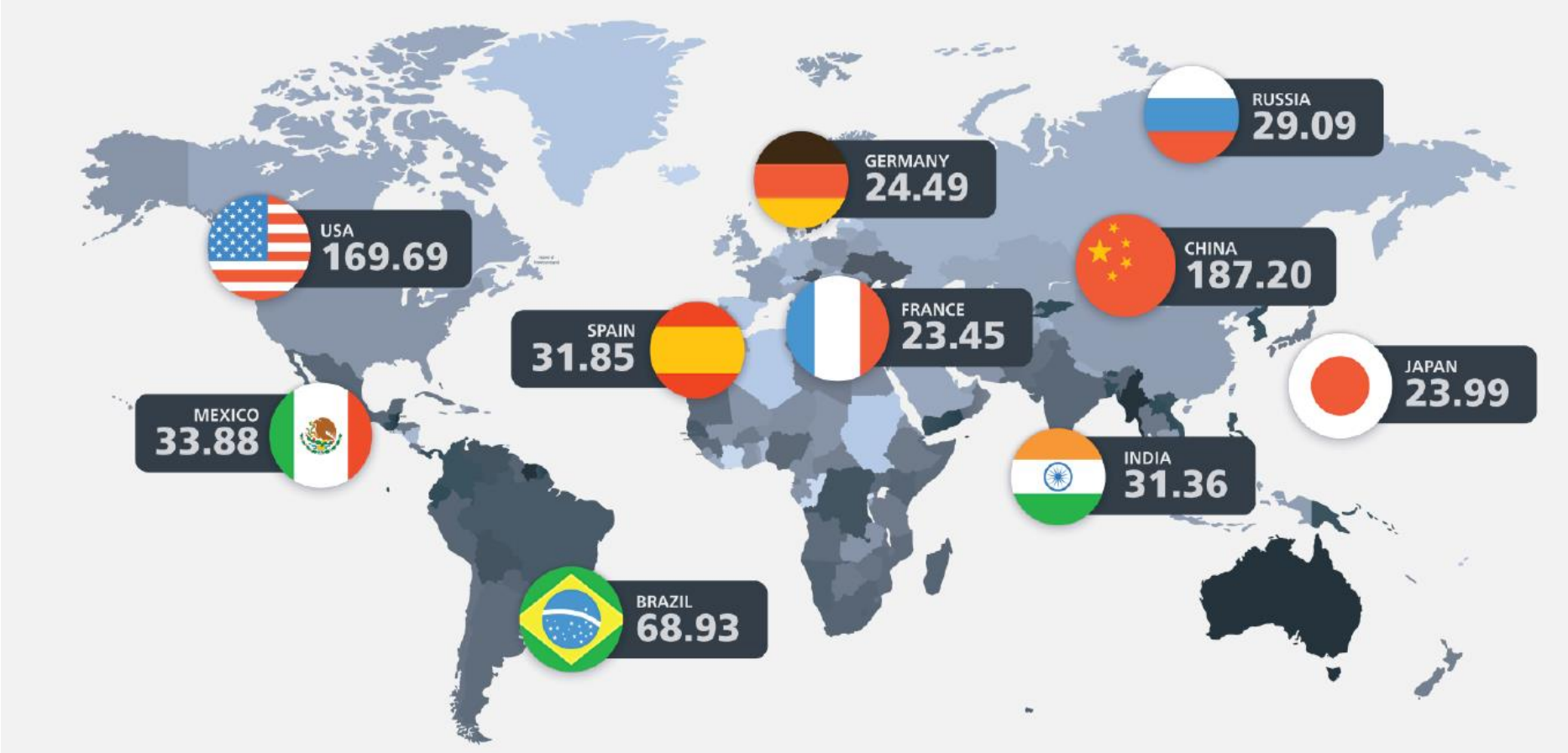
(€/100 kg, delivered on farm, 16 tons batch, excl. VAT)

	Protein level		
Scenario	**Low**	**Medium**	**High**
1 Standard situation	20.83	22.15	27.08
2 Without non-EU soy products	20.83	22.82	32.79
3 Only local feed materials	22.00	24.69	34.46
Extra costs for scenario 2, compared to scenario 1	**0.00**	**0.67**	**5.71**
Extra costs for scenario 3, compared to scenario 1	**1.17**	**2.54**	**7.38**

However...

- This case study indicates that local sourcing can have strong effects on raw material replacement
  - >50% in high protein feeds
- If local sourcing would be implemented at large scale
  - Demand for specific feed materials would change drastically
  - Feed material prices would be strongly affected
  - That would lead to a new balance in the market
  - Although the feed market is a global market... not a European market

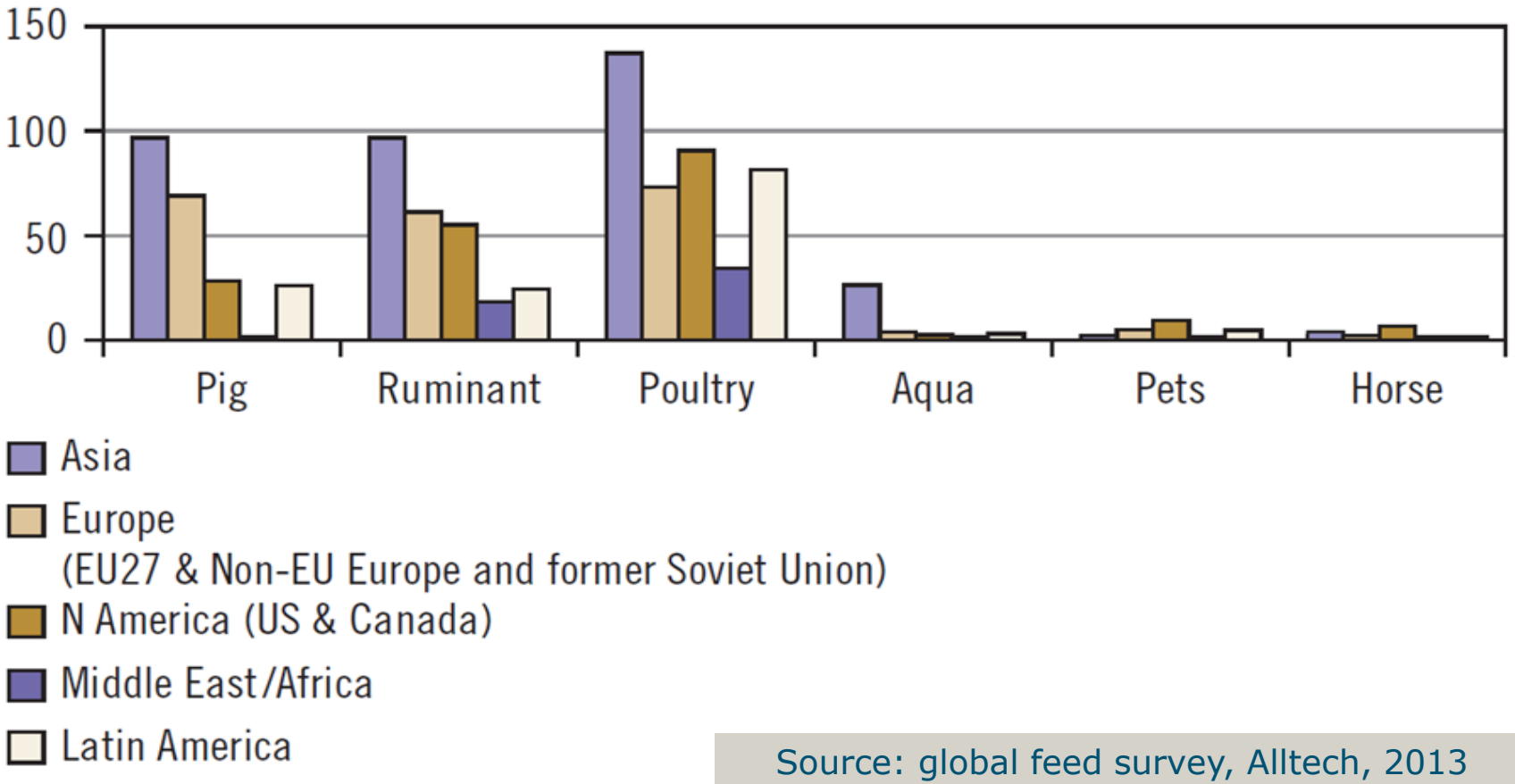
Top 10 feed producing countries (in million tons/year)



Source, Global feed survey, Alltech, 2017

Feed production per animal species and per global region

(million tons, 2012)



Source: global feed survey, Alltech, 2013

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How about sustainability?

- Sustainability assessments for different concepts of local sourcing are desired

- Local sourcing does not necessarily improve key performance indicators for sustainability, such as the carbon footprint...

Carbon footprint (CFP) of European feed materials (in CO2-eq/kg) compared to CFP of Latin American Soybean meal extract

	CFP total	Transport	Cropping	Processing
Soybean meal extract (Latin American)	598 (range 455-741)	125	382	91
Oilseed meals (European)				
Rapeseed meal extract	471	23	416	33
Sunflower expeller	705	34	664	11
Sunflower extract	575	27	525	23
Linseed expeller	501	22	462	17
Linseed extract	462	19	409	33
Pulses (European)				
Phaseolus Beans	780	10	766	4
Horse beans	553	61	492	0
Lupins	699	n.a.	699	0
Peas	457	n.a.	457	0

Based on: Vellinga et al. (2013)

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	CFP total	Transport	Cropping	Processing
Soybean meal extract (Latin American origin)	598 (range 455-741)	125	382	91
<u>Cereal by-products (European)</u>				
Wheat germ feed	698	71	568	59
Wheat gluten feed meal	497	28	229	239
Maize gluten meal	1023	66	546	420
Maize gluten feed	1846	75	618	1152
<u>Dried forages (European)</u>				
Dried alfalfa	1332	104	195	1031
Dried grass	1983	44	883	1056

Based on: Vellinga et al. (2013)

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Take home messages

- There is a societal trend towards local sourcing
- Local sourcing and purchasing in food production chains has various sustainability advantages
- Local sourcing of feed materials
  - has the risk of increasing the CO2 footprint/kg feed
  - increases compound feed costs, especially for high protein feeds
- Import of non-EU feed materials can be reduced by:
  - reduction of yield gaps in grass, forage and fodder crop production
  - reduction of field / conservation / feed-out losses of grass and forages
  - increased feed and nutrient use efficiency in animals
  - better use of co-products & residuals
  - innovations in novel European feed materials

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