

Webinar PPP

Circular Bio Economy

Increasing circularity in
animal feed: practical results
January 31, 2023



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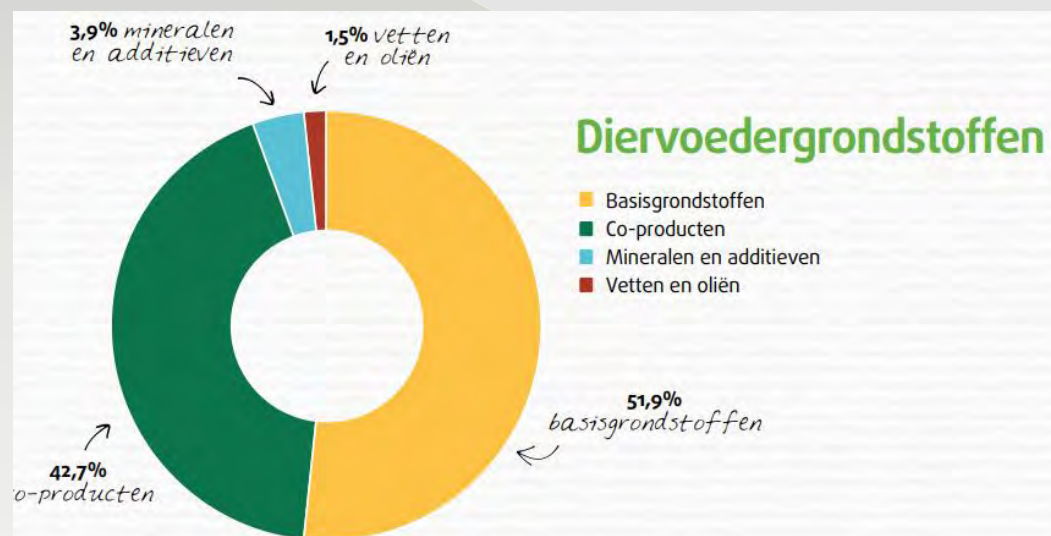
Gert van Duinkerken
Wageningen Livestock Research





Back in time

- 2017: “circularity” and “circular agriculture” in spotlight
- NL animal nutrition sector and livestock sectors are champions in the use of residues and co-products



Het totale volume bedraagt 16.7 miljoen ton, op basis van 88% droge stof
(voor mengvoederproductie en levering enkelvoudige voeders)

Bron: SecureFeed, 2018; CBS Statline, 2019; FAO-database, 2017

Nevedi, 2019



Back in time

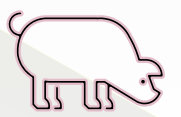
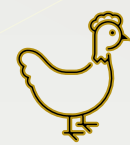
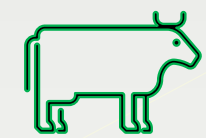
- Questions

- > Can we use even more residues and co-products?
- > Can we increase their utilisation and nutritional value?
- > Full use of biomass, at highest value
- > As sustainable as possible

- Can we make this a joint effort?

- Industry + research + public support

- > PPP started in 2018



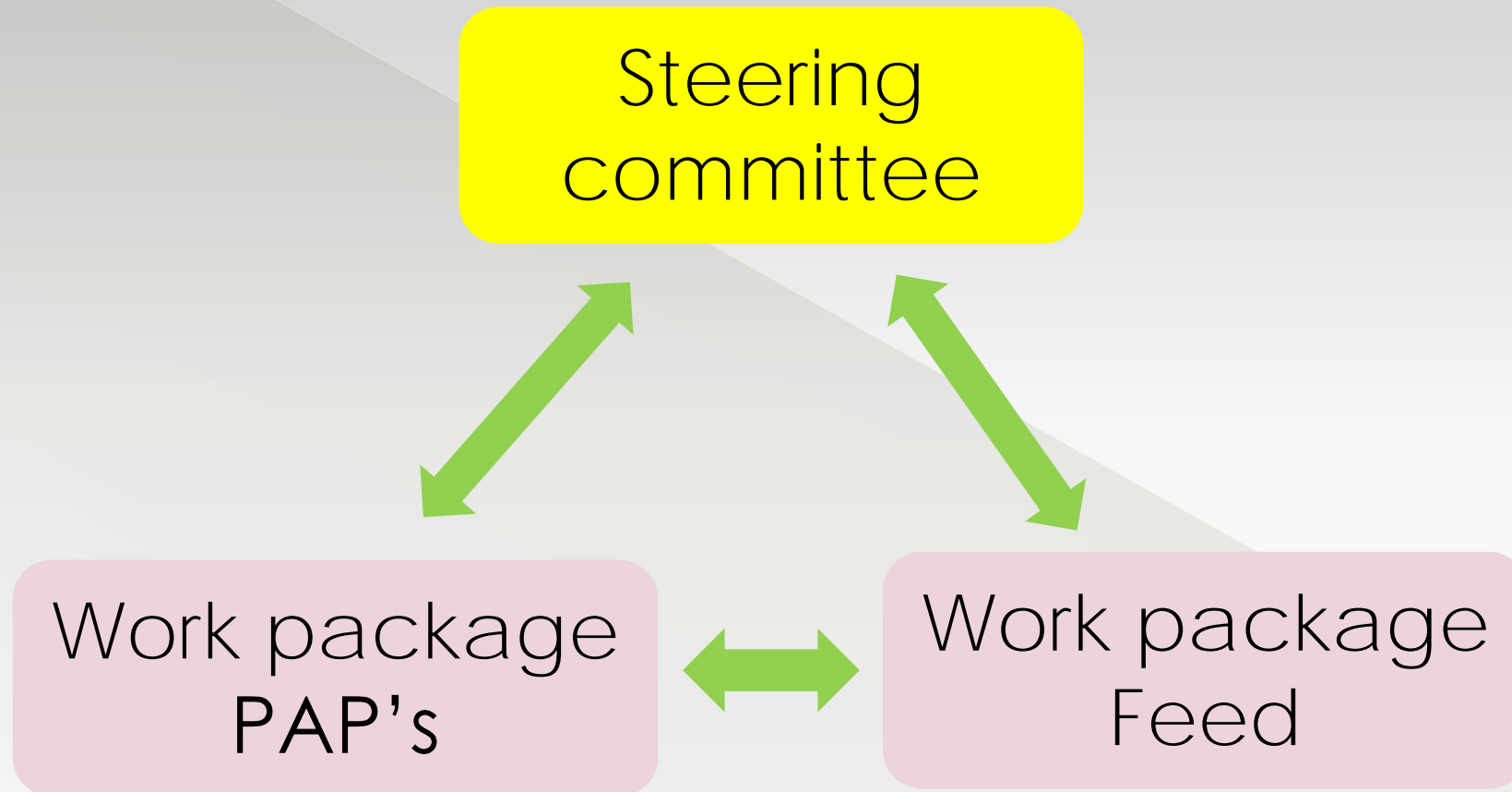
Partners



- ◉ ABZ Diervoeding
- ◉ AgruniekRijnvallei Voer BV
- ◉ Bonda's veevoederbureau BV → Agrifirm
- ◉ Coppens Diervoeding → De Heus
- ◉ Darling Ingredients International Rendering and Specialties BV
- ◉ EFPRA
- ◉ Feed Design Lab
- ◉ Noblesse Proteins
- ◉ Nijsen/Granico BV → Nijsen Company
- ◉ SARIA International GmbH
- ◉ Schothorst Feed Research
- ◉ Vitelia Voeders BV
- ◉ Wageningen Livestock Research



PPP Circular Bio Economy

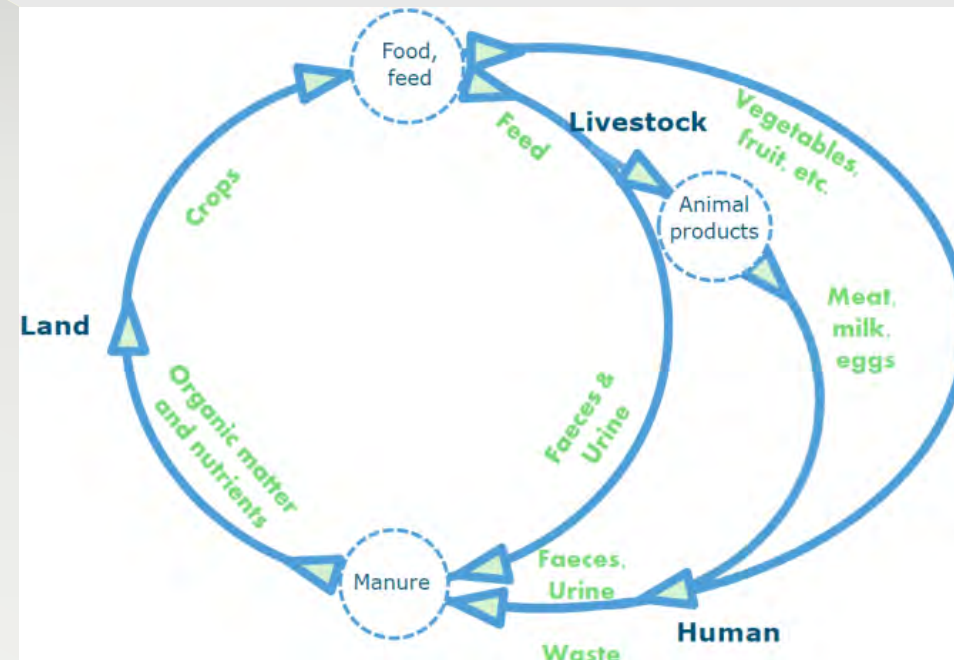


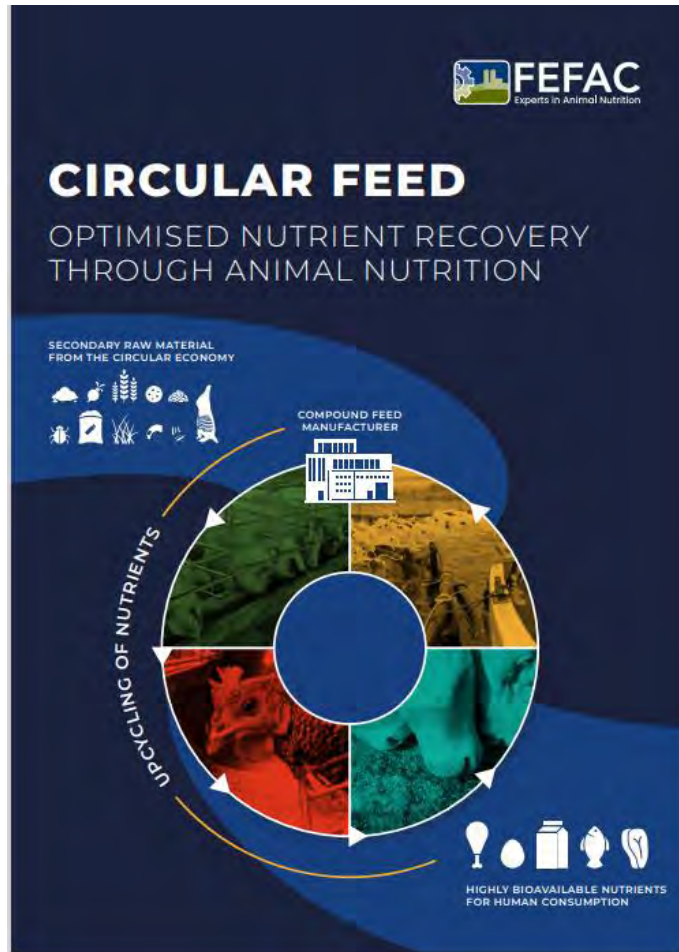
But what exactly is “circular feed”?



This questions is discussed at many places, for example

- Fefac: “Circularity metric”
- Individual feed companies: “Fit4Feed” concept Agrifirm
- Research programs like “Kringlooptoets”





"The upcycling of nutrients through farm animals, converting secondary raw materials to highly-bioavailable nutrients for human consumption, is an important part of our license to produce as European feed manufacturers."

Fefac's product-based definition for circular feed:
4 components jointly form the circularity metric





Key questions:

- > what is the % of commodities for feed that are not fit for food;
- > is it possible to 'label' a feed as circular or not circular;
- > is it possible to develop a circular feed with other environmental benefits;
- > what is vision on circular feed (local, not competitive, reduce 'loss' etc.)?

Scope of “Fit4Feed”



> Classification of raw materials based on the competition with human food

> Five main categories:

> Category 1: Primary raw materials (e.g., cereals, legumes)

> Category 2: Co-products (e.g., rapeseed meal, wheat bran, PAPS)

> Category 3: Former foodstuffs

> Category 4: Additives, minerals, premixes

> Category 5: Roughage



[illegible]

Noem één
MINST
 circulair
 diervoer

Noem één
MEEST
 circulair
 diervoer

Noem één
 diervoer
 waar je
twijfelt

- ✓ Een **circulaire grondstof**;
- ✓ wordt **ingevoerd op de manier** waarop deze het **meest optimaal** kan worden benut (**feed-fod-fuel** competitie);
- ✓ **minimaliseert grondgebruik**
- ✓ draagt bij aan een **blijvende vruchtbaarheid** van landbouwgrond.

Oorsprong van de grondstof	Caractéristiques de la matière	Respecter le produit	Valeur du produit	Upward pricing	Effet de l'exportation à l'étranger
<ul style="list-style-type: none"> deur van land, biogroei deur van productie herkomst / afkomst? 	<ul style="list-style-type: none"> bruikbaarheid grondstof als feed alternatief gebruik voor feed 	<ul style="list-style-type: none"> direct bodem gebruik direct gebruik als ander grondstoffen direct energie gebruik 	<ul style="list-style-type: none"> gebruik bodem vruchtbaarheid bijdrage aan de afname van bodem kringloop 	<ul style="list-style-type: none"> verbetering van kwaliteit van vee-feed toepassing opwekking van vee-feed toepassing 	<ul style="list-style-type: none"> bevestigde waarde van vee-feed gebruik afkomst efficiënte als diervezel optimalisatie van de herbruikbaarheid van voedingsstoffen

Veel soorten (herkomst) veevoer

The diagram illustrates the complex flow of feed ingredients within the Agri-Food System (AFS). It shows the integration of various stakeholders and their interactions in the production and distribution of feed.

Legend:

1. Producten productie
2. Invoer productie
3. Product productie partij
4. Product productie partij
5. Product productie partij
6. Product productie partij

Stakeholders and Processes:

- AFS (Agri-Food System):** Central node representing the overall system.
- PPS (Productie Productie Service):** Stakeholder involved in the production process.
- HVC (Hoeve Voeder Coöperatie):** Stakeholder involved in the distribution of feed.
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- **Primair bedrijf:**
 - Hoe ziet mijn huidige circulaire performance eruit?
- **Mengvoedindustrie:**
 - Is voergroedstof X van leverancier A meer circulair dan Y van leverancier B?
- **Voedselproducenten:**
 - Ik heb een co-product uit mijn productieproces. Hoe kan ik deze het meest circulair inzetten (food, feed, fuel, fibre, fertilizer, ...)?
- **Retail/Overheid/Onderzoek:**
 - Welk diët draagt bij aan het meest circulaire systeem en welke rol heeft dierlijke productie in dit systeem?



1. Circulariteit is **één extra klokje** op het duurzaamheids-dashboard
2. Circulariteit gaat altijd over het **voedselsysteem als geheel**
3. We willen **handelingsperspectief in het bestaande systeem** verbinden met keuzes in een **toekomstig circulair voedselsysteem**
4. Uitkomst is **niet** wel of niet circulair, maar **wél** meer of minder circulair in vergelijking met alternatieven
5. Op basis van 3 variabelen: **landgebruik**, **P-gebruik** en **humaan voedsel**

*Vijf stappen voor het bepalen van
het effect van toepassing van een veevoergrondstof,
op de circulariteit van het voedselsysteem*

1. Specificeren van vraag en context
2. Uitdagen op alternatieven
3. In kaart brengen van de consequenties
4. Analyse van de indicatoren
5. Interpretatie

Met drie voorbeelden

1. Van gras naar grasklaver in de melkveehouderij
2. Toepassing van bierbostel
3. Europees geteelde soja in plaats van Zuid-Amerikaans geteelde soja

Land- en P-gebruik	Circulariteit van de teelt	Veevoer grondstof	Circulariteit van toepassing	Voedsel-bijdrage
<p>Geleidelijke allocatie</p> <p>Wat is de totale hoeveelheid van dit gewas? En hoe wordt het verdeeld over alle gebruikers?</p>	<p>Reststromen</p> <p>Wat is de hoeveelheid van deze reststroming? En hoe wordt deze op optimale manier gebruikt?</p>	<p>Co-producten</p> <p>Wat is de hoeveelheid van deze co-producten? En hoe wordt deze op optimale manier gebruikt?</p>	<p>Voedselgewassen</p> <p>Wat is de hoeveelheid van deze voedselgewassen? En hoe wordt deze op optimale manier gebruikt?</p>	<p>Hoeveelheid en kwaliteit geproduceerd voedsel</p>
<p>Volledige allocatie</p> <p>Waar is de volledige hoeveelheid van dit gewas? En hoe wordt het verdeeld over alle land en P gebruikers?</p>				

WAGENINGEN
Research & Innovation

application

Toepassing van het definitiekader

Toepassing nu

Belangrijke
ontwikkelpunten

 **WAGENINGEN**
UNIVERSITY & RESEARCH

6 Principles *when defining "circular feed"*

1. Circularity **one extra clock** on sustainability dashboard
2. Circularity concerns the **integral food system**
3. Circularity is **context** and **time dependant**
4. Circularity is **relative**, no absolute value
5. Should be determined on a **minimal number of variables**
6. Definition requires **action perspective now** & **development path for the future**



Program	Start	Speaker
Circular Bio-economy: background of the project	13.30	Gert van Duinkerken (Wageningen UR; chair)
Work package Processed Animal Proteins		
Developments regarding PAPs over the last ten years	13.45	Martin Alm (EFPRA)
Nutritional value of PAPs for pigs and poultry	14.00	Roger Davin (Schothorst Feed Research)
Consumer perception of PAPs in animal diets	14.15	Gemma Tacken (Wageningen UR)
Break	14.30	
Work package FEED		
How to improve applicability of wet co-products in pig diets	14.35	Martin de Groot (Bonda)
Processing of novel proteins and use in broiler diets	14.50	Ellen van Eerden (Schothorst Feed Research)
Screening checklist for applicability of new feed materials	15.05	Sharon van Schaijk (Agruniek Rijnvallei)
General discussion and closure	15.20	
Closure	15.30	

Webinar PPP

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January 31, 2023

Dr Martin Alm
Technical Director, EFPRA





Overview of the Animal By-Products Industry in Europe in 2021

Dr Martin Alm

Technical Director,

European Fat Processors and Renderers Association (EFPRA)

Overview of EFPRA







We currently represent:

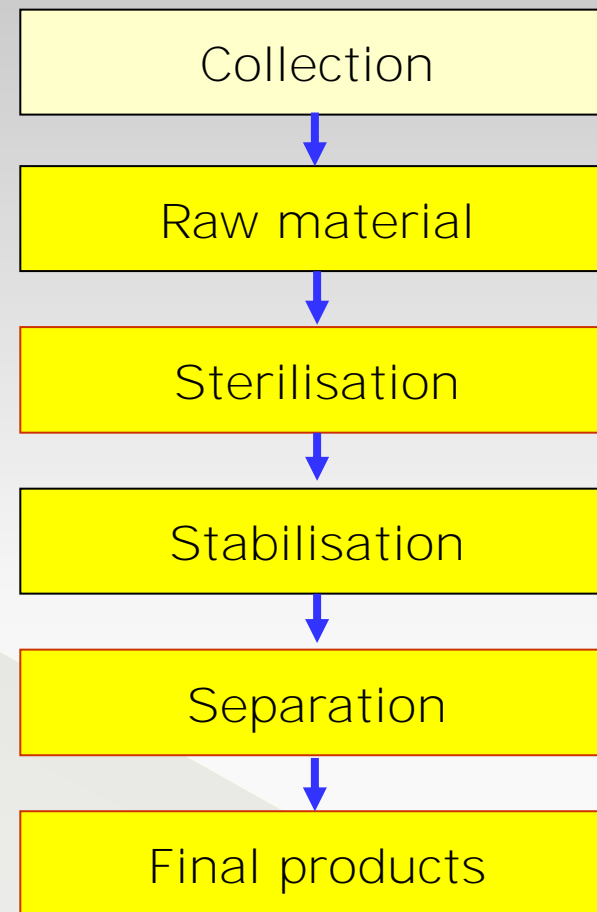
- ◉ 30 members in 25 European Countries, 1 associate member
- ◉ The processing of 18,6 MT raw material into over 3 million tonnes animal fat and nearly 4,1 million tonnes animal proteins
- ◉ 472 different lines (from food to category 1) in 246 processing plants and 189 intermediate (collection) plants in 21 European countries (18 EU + 3 Non-EU)
- ◉ 17.700 employees

What's rendering?



Slaughtered animal	Meat (%)	By-products * (%)
Chicken 	68	32
Pig 	62	38
Cow 	54	46
Sheep / Goat 	52	48

- By-products are used for food or non-food production, e.g. casings, gelatin, fat melting or animal by-products (cat. 1-3)



Classification of animal by-products in European ABP regulation 1069/2009



ABP regulation (EU)

1069/2009 and 142/2011

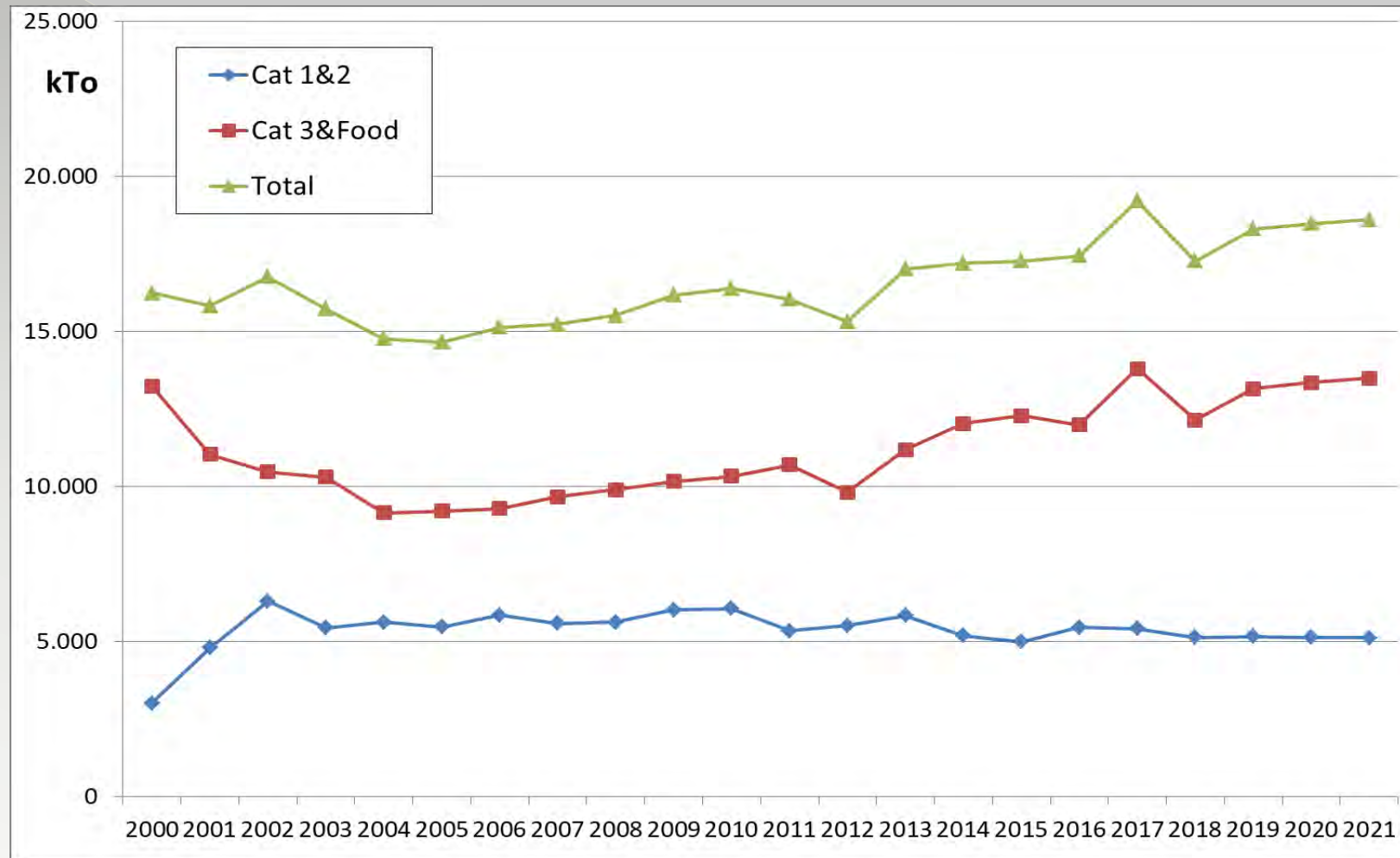
Classification of ABP according to risk to human/animal population and the environment

- Category 1: Materials related to TSE, toxic concentrations,
 - Not fit for food/compound feed
 - Incineration required
- Category 2: Fallen stock non-ruminant,
 - Not fit for food/compound feed
 - Fertiliser, soil improver, fur animals

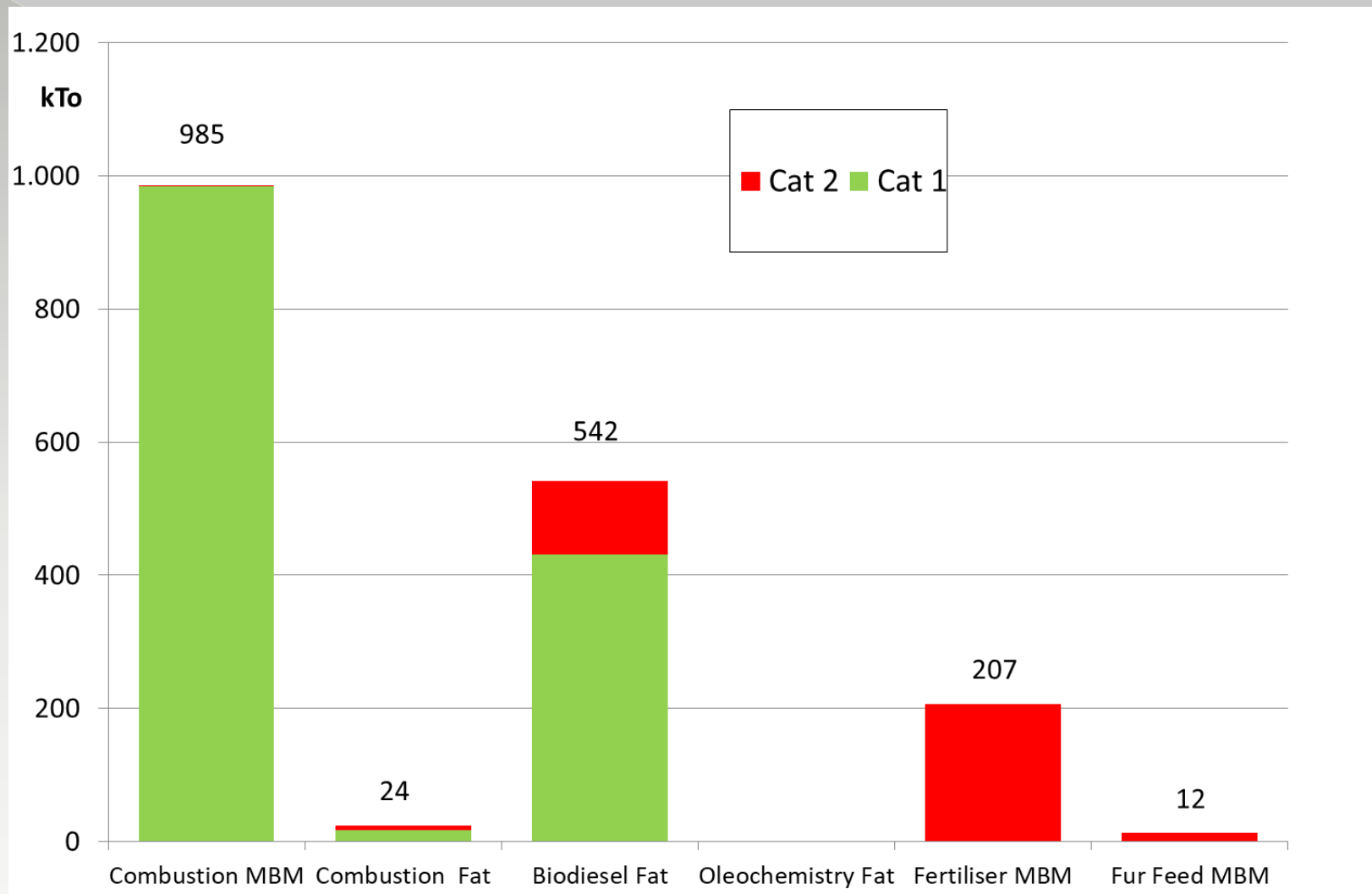
Feed

- Category 3: « Carcasses and parts of animals slaughtered and fit for human consumption, but not intended for human consumption for commercial reasons. »
 - Fit for compound feed, pet food, aqua feed,...

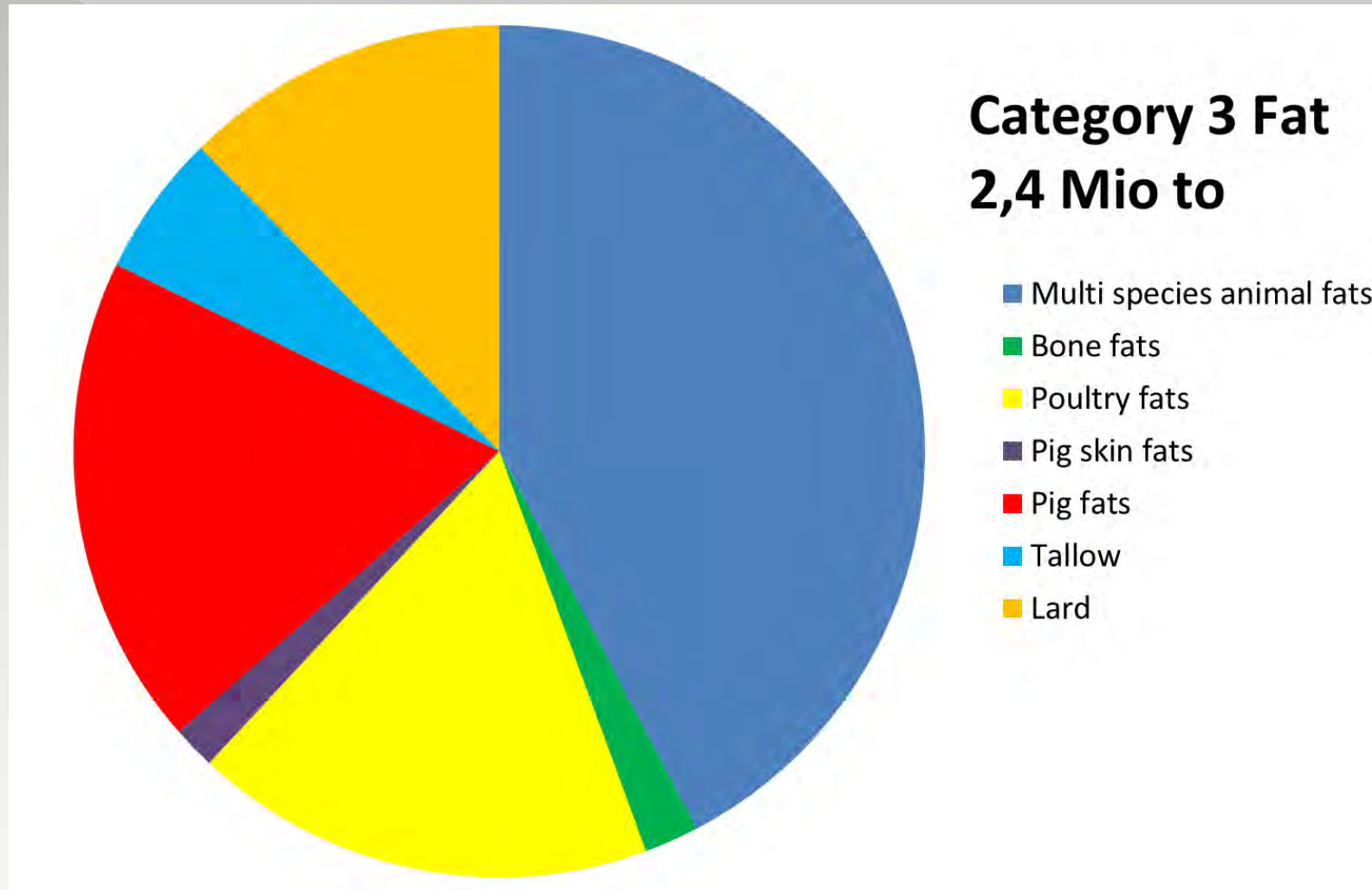
Development of ABP Processing 2000 – 2021 (21 Countries)



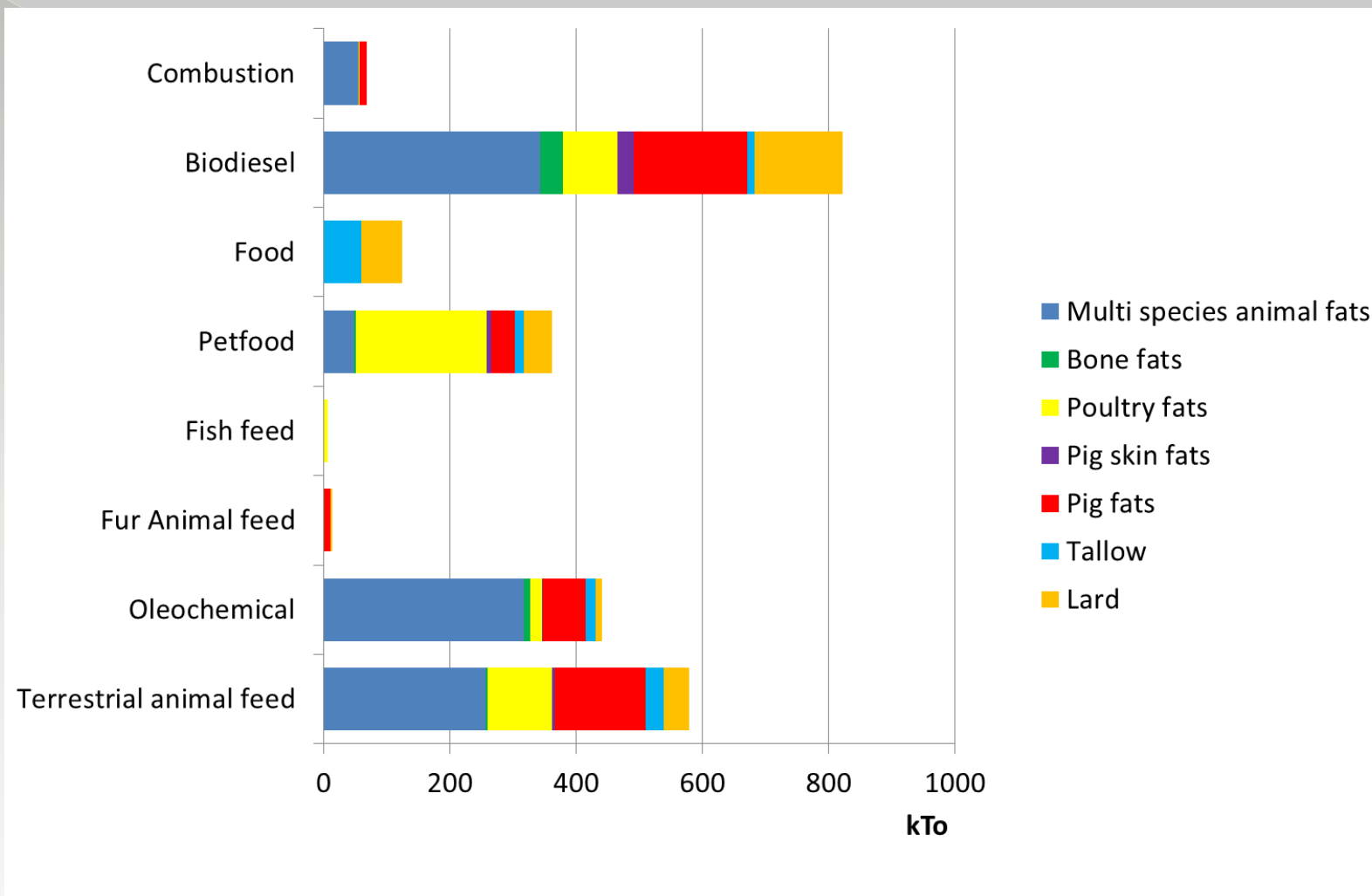
Use of Category 1 and 2 Products



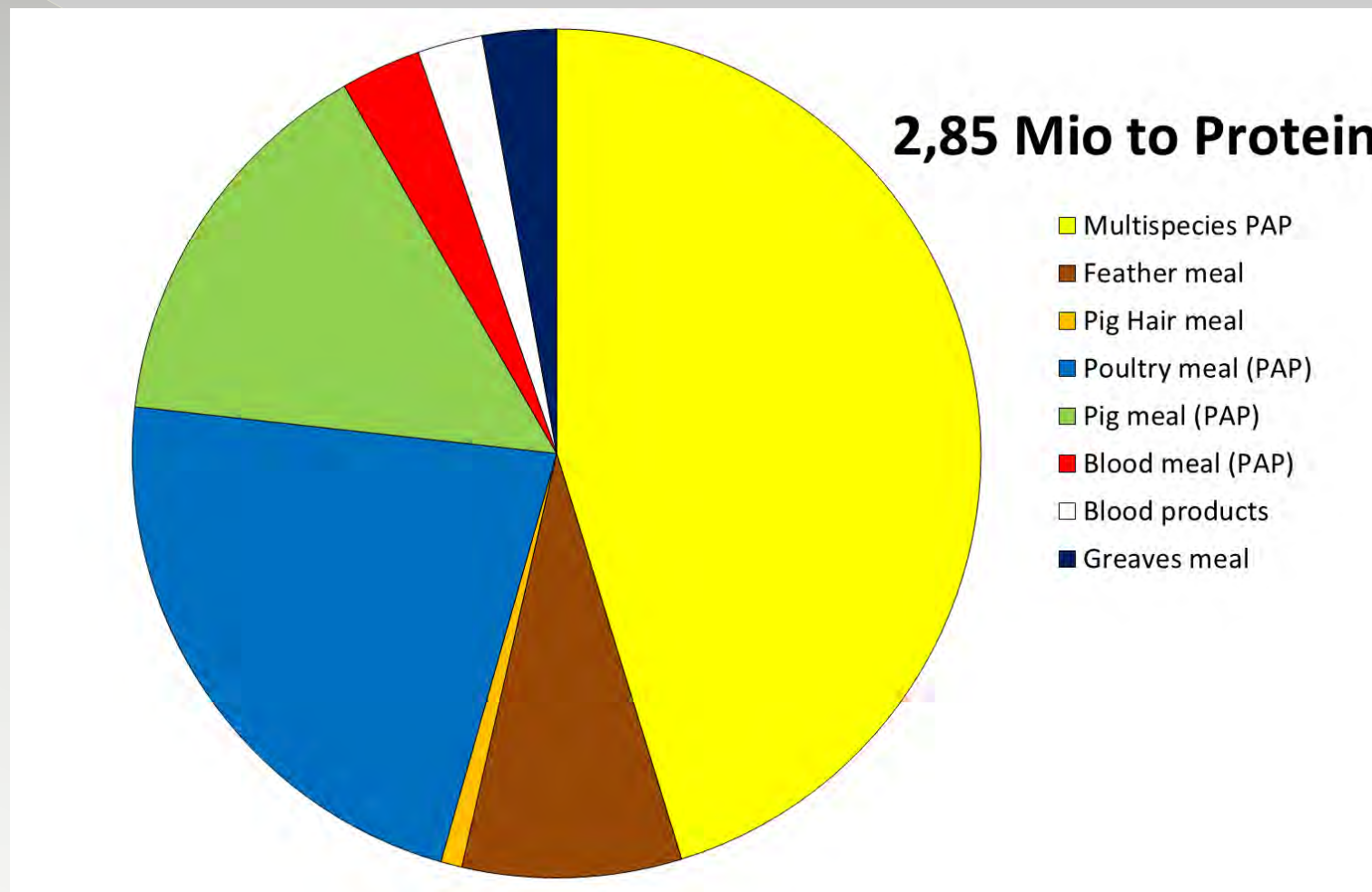
Production of edible and Category 3 Fat



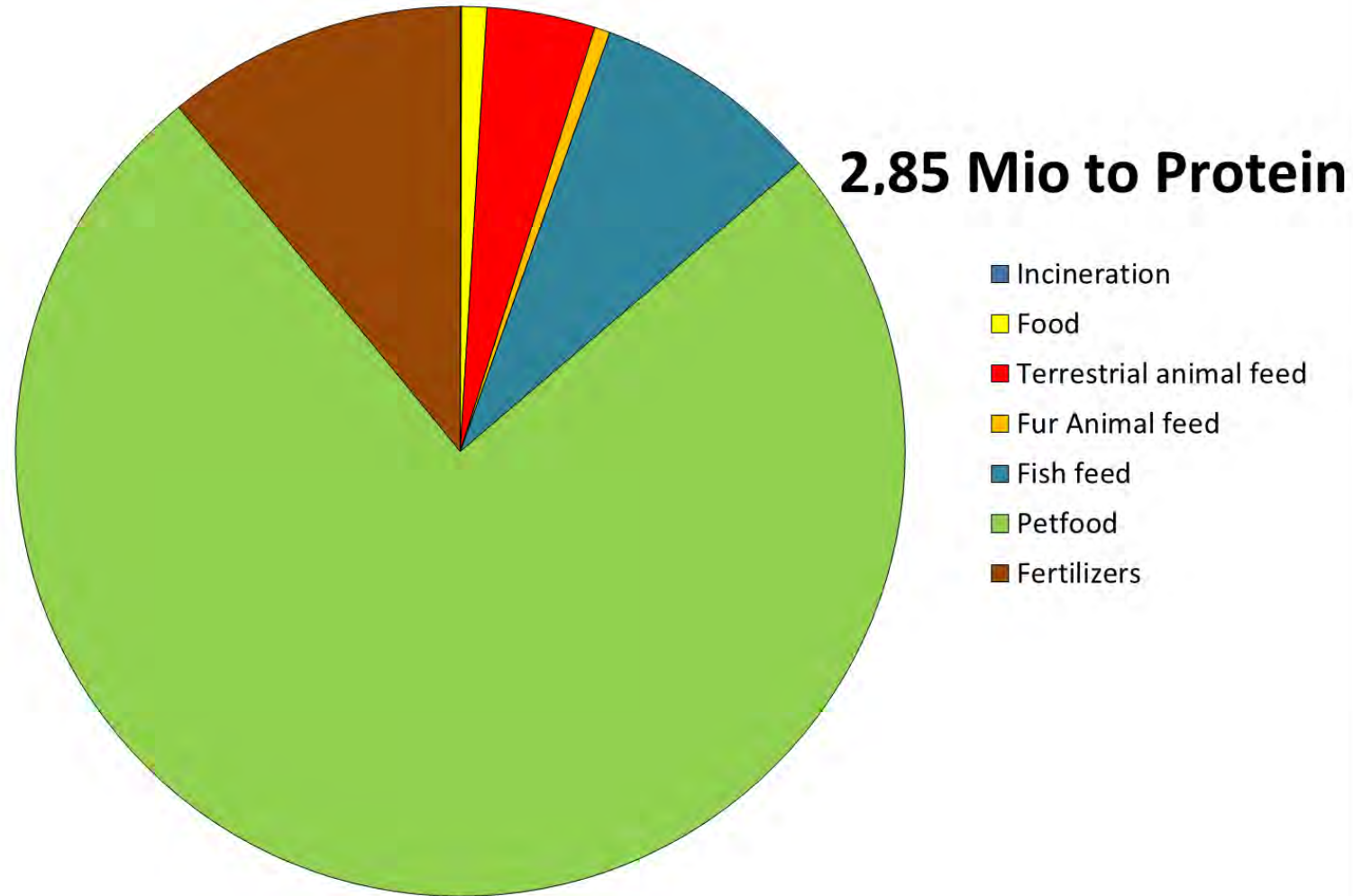
Destination of Edible and Category 3 Fat



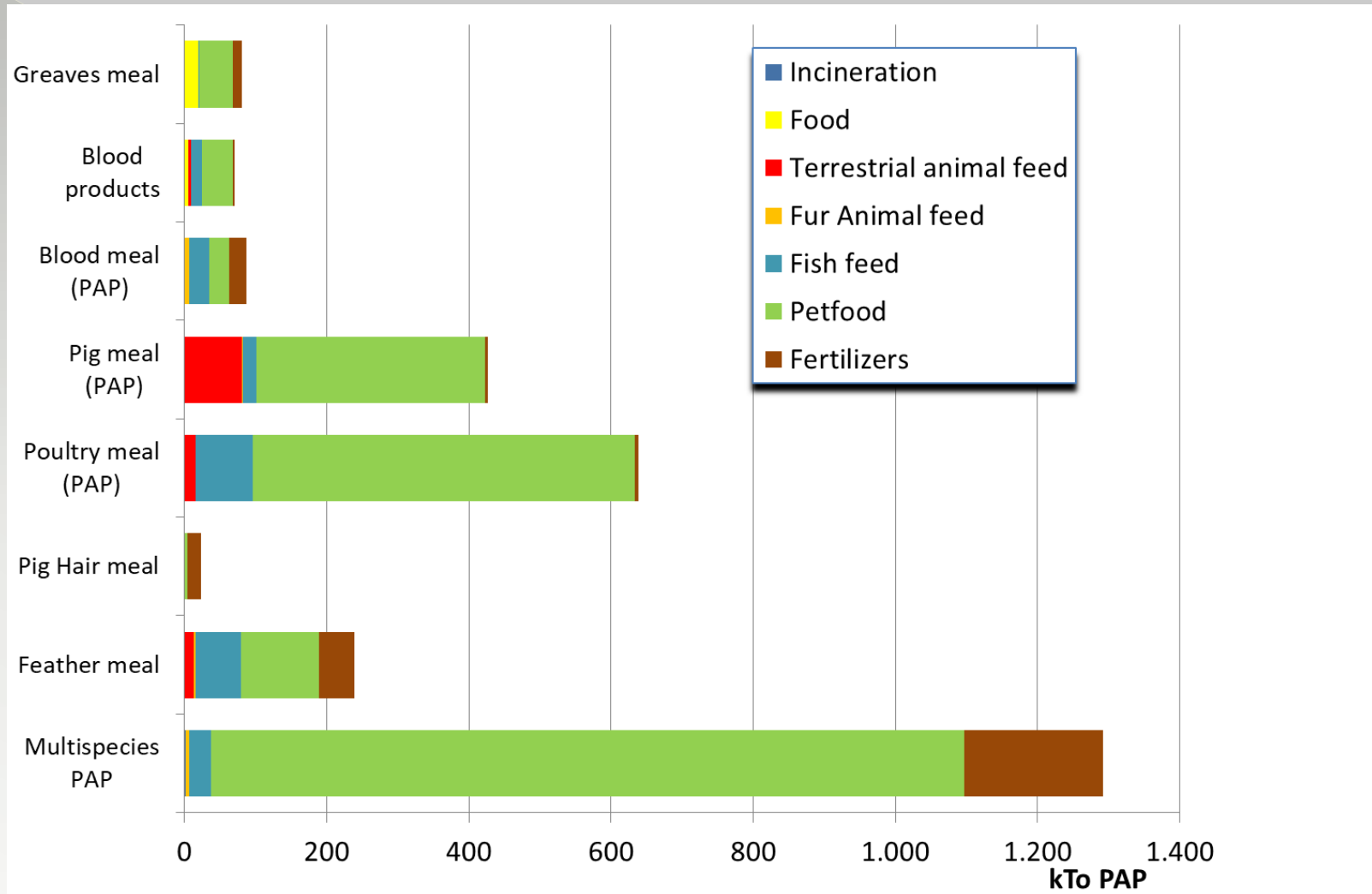
PAP and Food Grade Protein Production



PAP and Food Grade Protein Destination



PAP and Food Grade Protein Destination



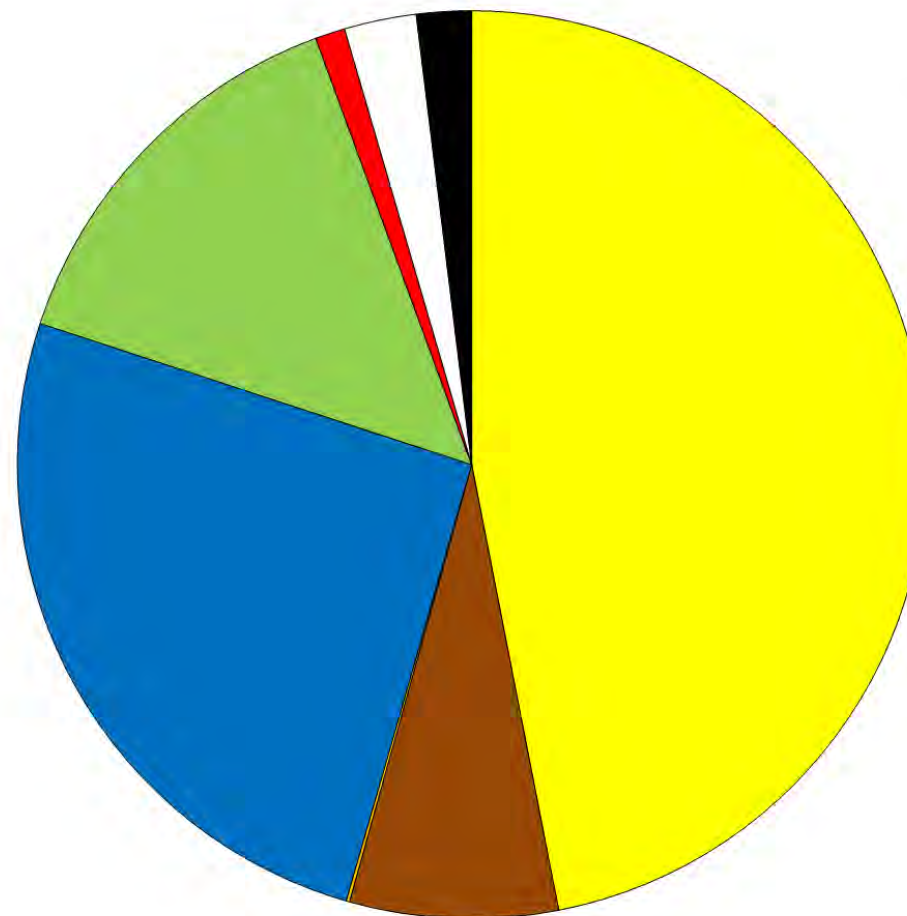
Petfood



PAP in Petfood



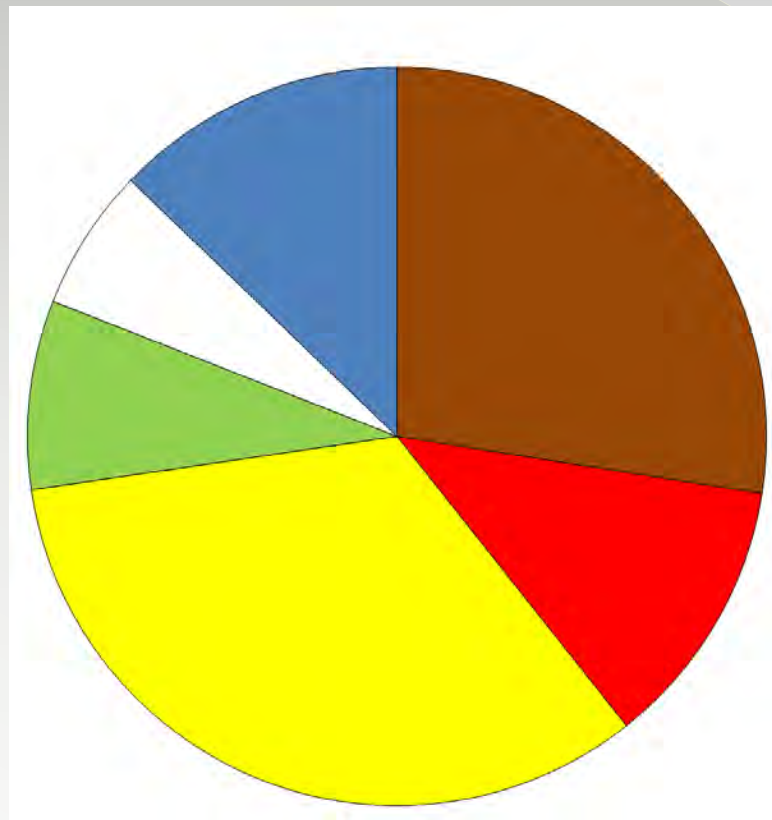
**2,15 Mio to
Petfood**



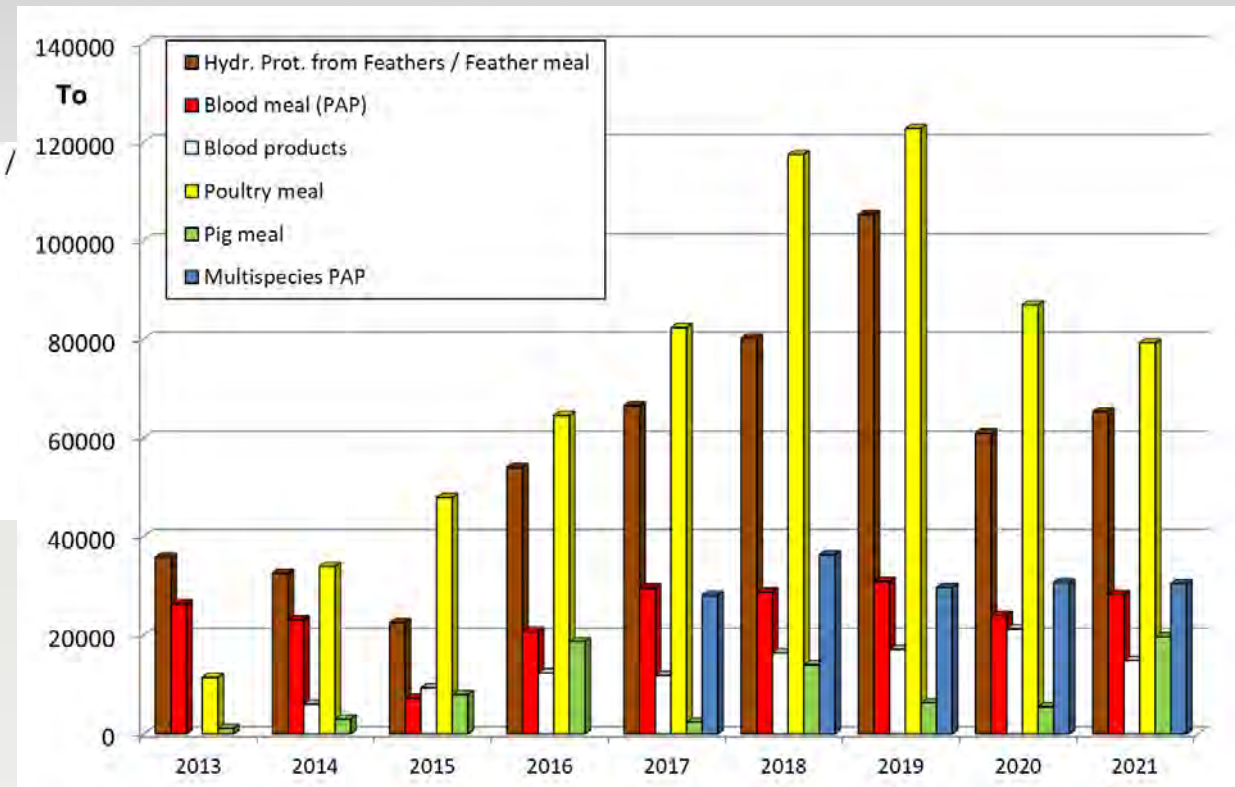
Aquaculture



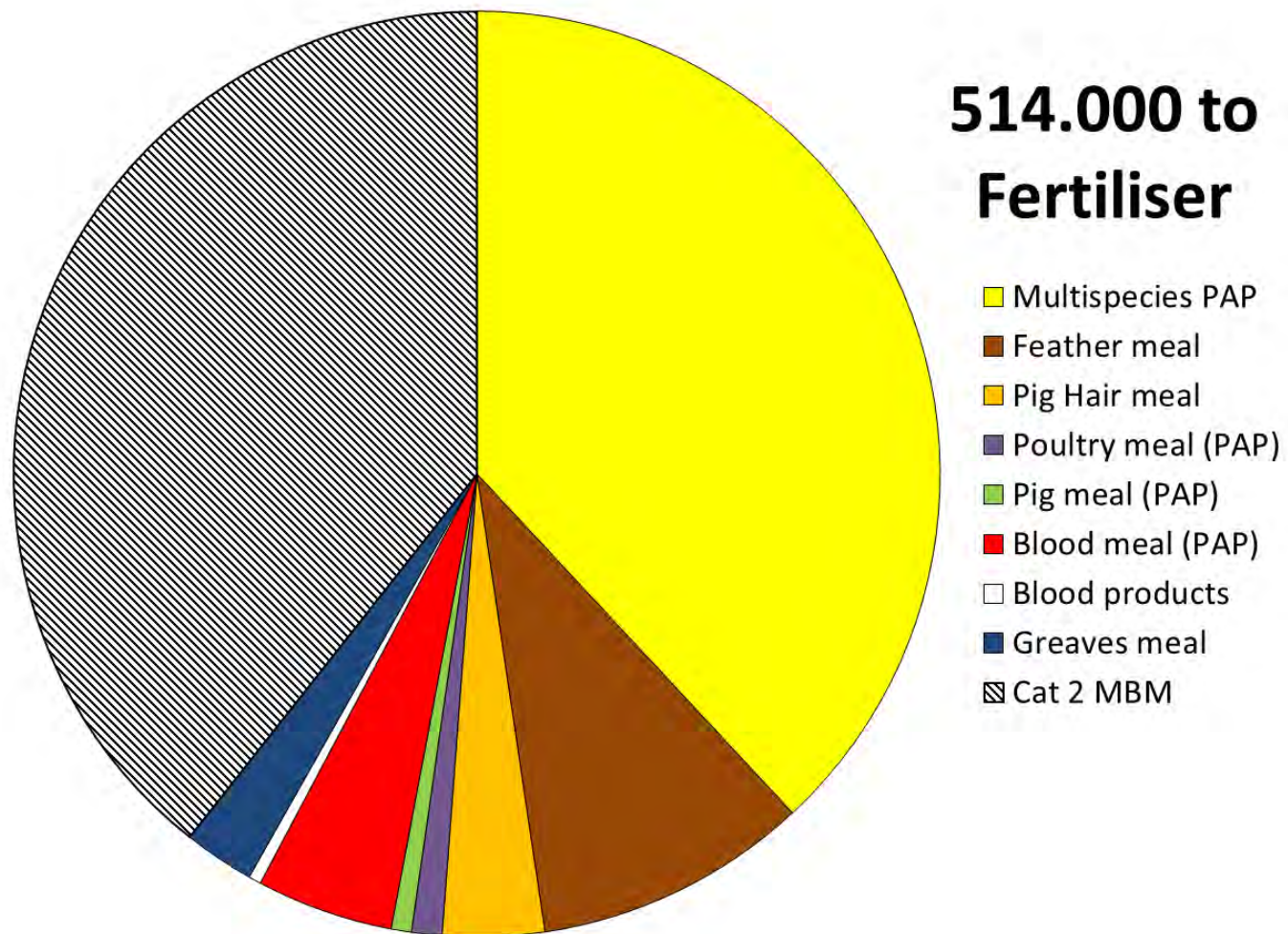
- 238.000 tonnes to aqua feed



Hydr. Prot. from Feathers /
Feather meal
Blood meal (PAP)
Poultry meal
Pig meal
Blood products
Multispecies PAP

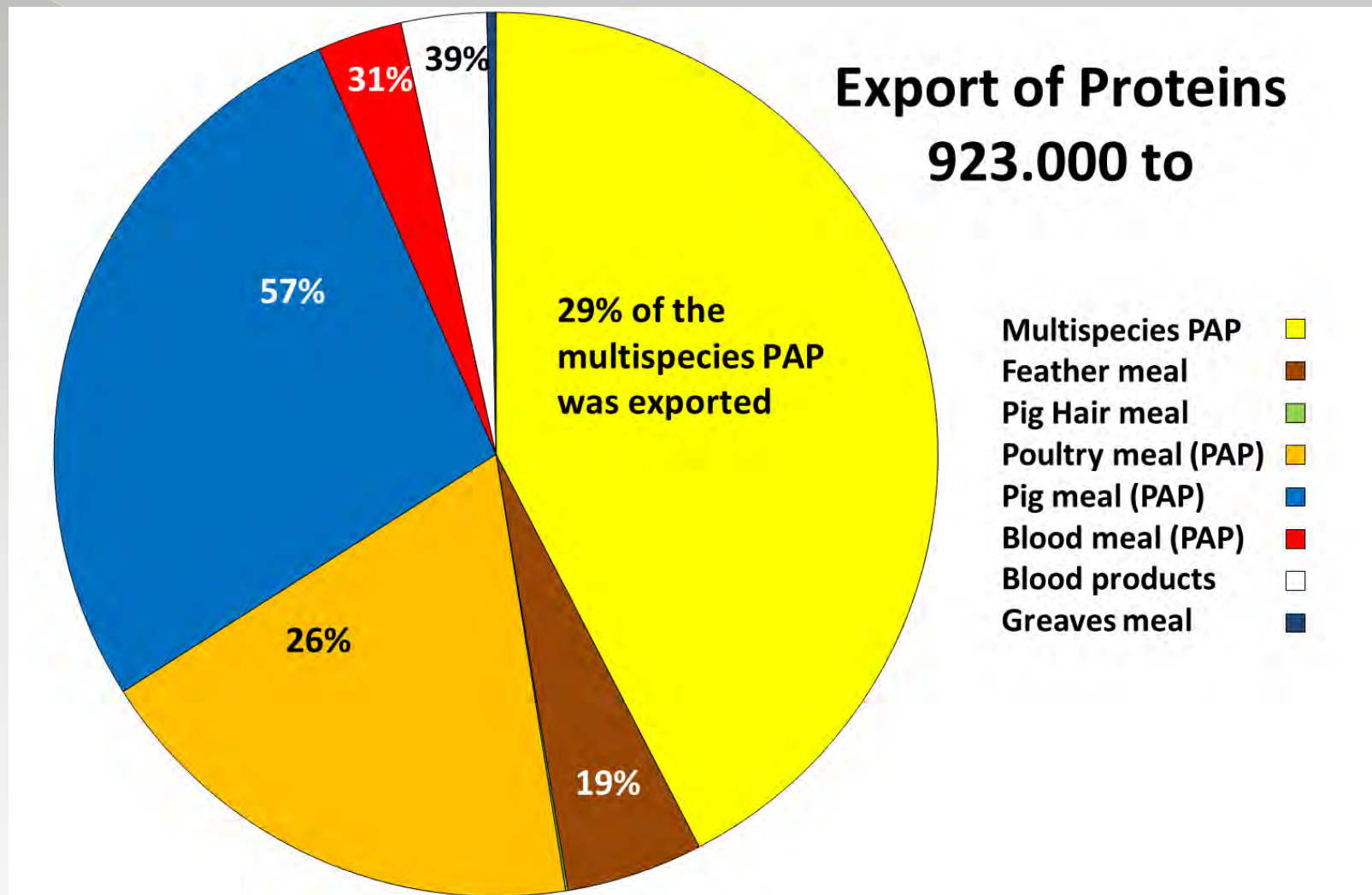


Fertiliser

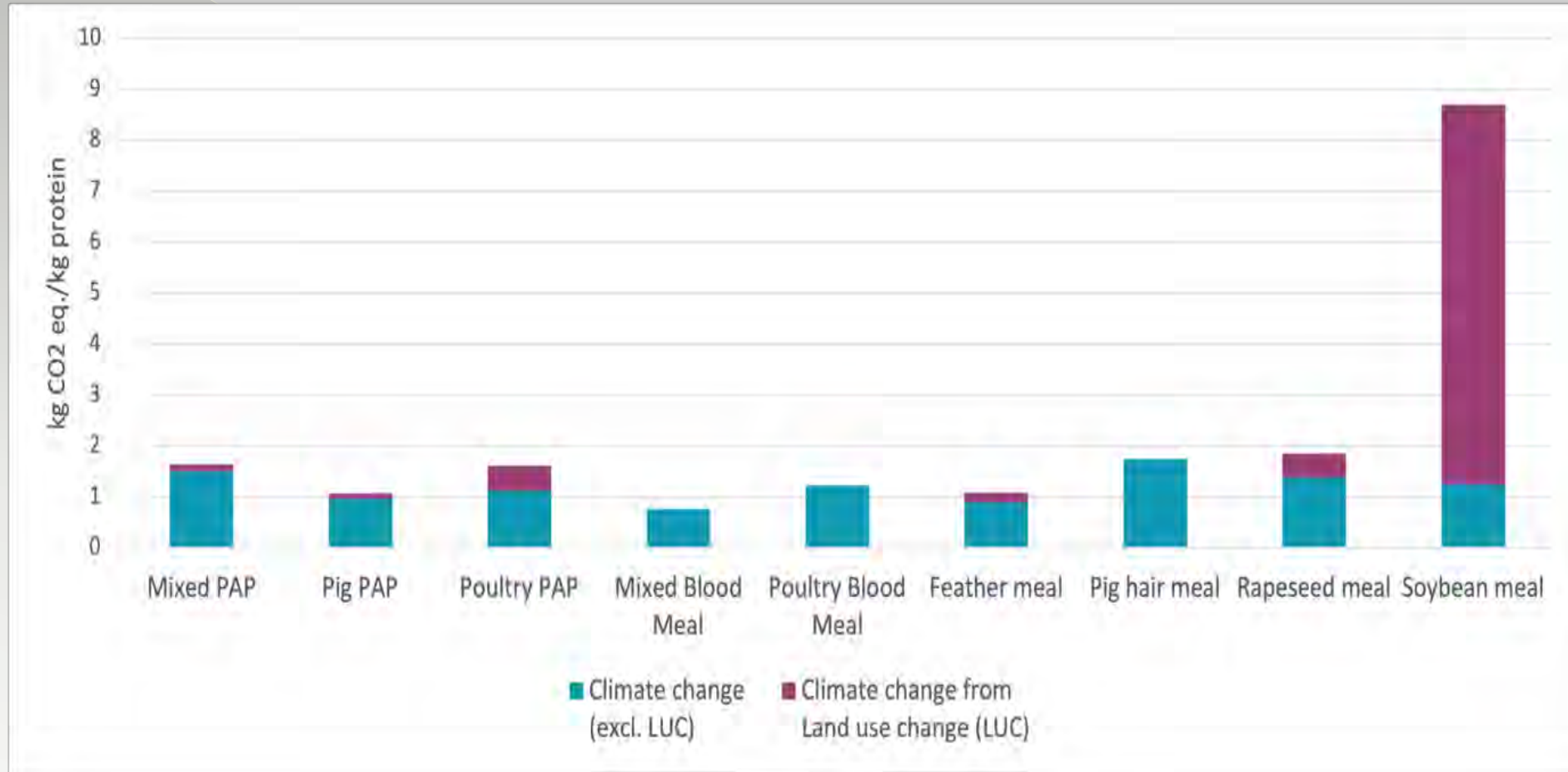




Export of PAP to Third Countries 32%



Sustainability of PAP / GFLI Standard (kg CO₂ eq./ kg protein)



Conclusions



- Animal By-Products slightly increasing over the years
- Grow in the category 3 and food sector
- Consequences of the feed ban for PAP
 - Pet food key market for PAP
 - 1/3 of PAP is exported
 - Aquaculture comes back slowly
 - Comeback of feed expected
- PAP is highly sustainable (GFLI)



Thank you very much
for your attention

Further information under: efpra.eu

Webinar PPP

Circular Bio Economy

Nutritional value of PAPs for pigs and
poultry

January 31, 2023

Roger Davin
Schothorst Feed Research



Use of PAPs in swine diets



- ◉ Table values are outdated
- ◉ PAPs of poultry origin for swine
- ◉ PAPs of swine origin for poultry
- ◉ Variability on PAPs composition and digestibility:
 - › Meat, bones, feathers, blood
 - › Processing methods

In vivo studies conducted within this PPS



- ◉ Digestibility study in Grow-finishing pigs
- ◉ Validation trials in swine:
 - > Weaned pigs
 - > Grow-finishing pigs
- ◉ P digestibility study in broiler chickens

Digestibility study in Grow-finishing pigs



		Test products	Ash, %	CP,%
1	Basal diet	--		
2	Basal diet	Poultry Meal- high ash	32	53.4
3	Basal diet	Poultry Meal- medium ash	12	67.4
4	Basal diet	Poultry Meal- low ash	12	67.9
5	Basal diet	Feather meal - hydrolysed	1.3	88.6
6	Basal diet	Poultry Blood Meal - Spray Dried	2.5	93.4

48 pigs – 8 replicates / treatment





Total tract digestibility of PAPs

Period 2

	OM		CP		Fat	
	%		%		%	
Poultry Meal-High	74.9		82.9	b	52.7	a
Poultry Meal-Med	83.3		84.6	b	83.3	b
Poultry Meal-Low	81.7		83.1	b	81.1	b

- ATTD of CP agreed with table values
- ATTD of fat in line with CVB, higher than INRA (65%)
- In combination with other data: Poultry Meal not essentially different from mixed species, but variation between products

Total tract digestibility of PAPs

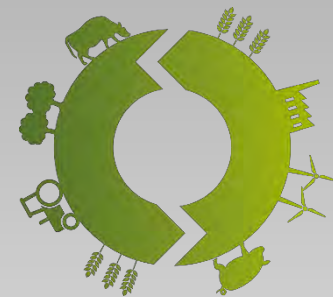
Period 2



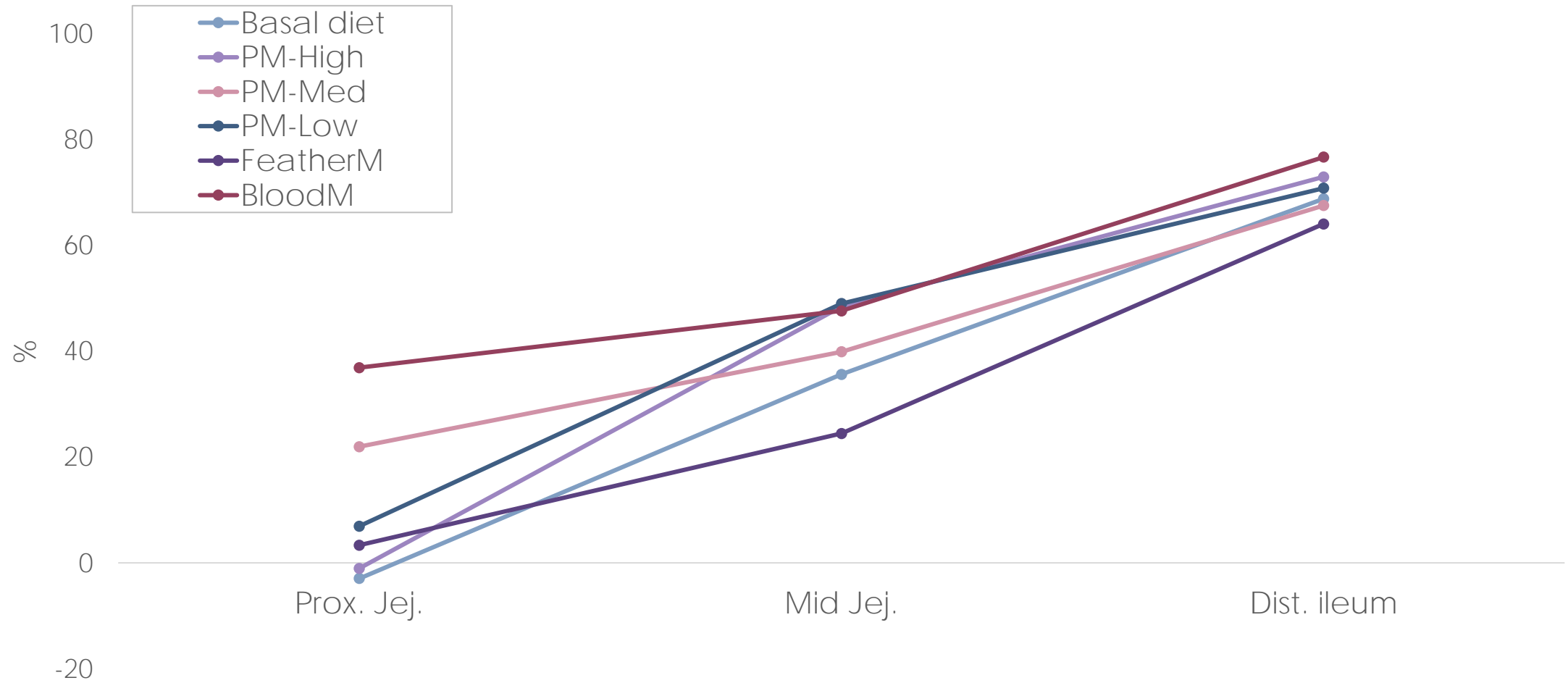
	OM		CP		Fat	
	%		%		%	
Feather Meal	73.6		75.3	a	65.0	a
Blood Meal	79.5		82.9	b	nd	

- Feather meal: ATTD of CP agreed with table values, for fat 5-10% lower, may be due to species and processing
- Blood meal: ATTD of CP slightly below table values

Ileal CP digestibility vs. table values



CP digestibility in different intestinal locations (Kinetics)



Summary & Conclusions



- Poultry Meal: overall digestibility in line with feed tables, but variation between products need to be accounted
- Poultry Meal: high ash affects AA-pattern, no reduction in AID of CP (and AA)
- Feather Meal: AID CP and AA was relatively low, esp. for CYS; presumably role of origin and process
- Blood Meal: (poultry) specific AA-pattern, not in digestibility
- Rate of digestion: high for blood meal, low for feather meal
- New PAPs may be used in EU on species-specific basis and require a specific entry in feed tables

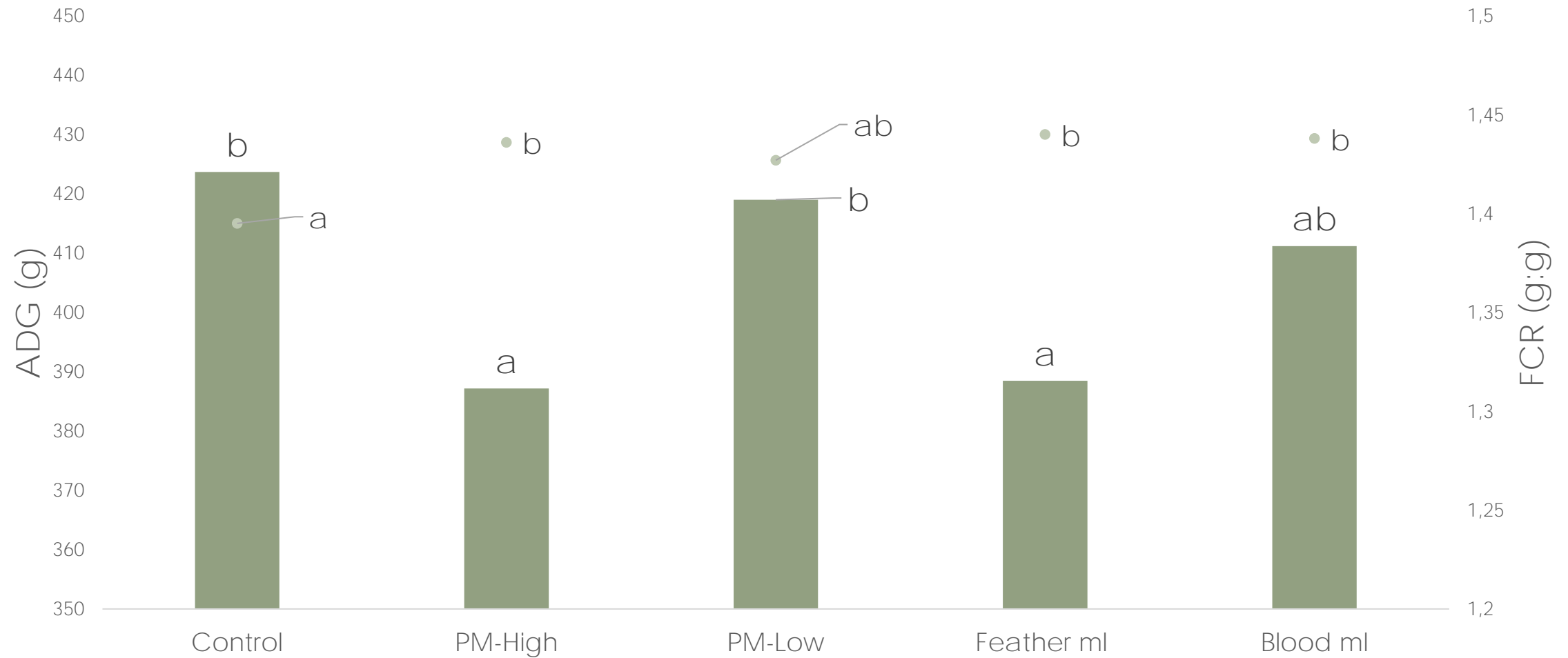


Follow-up study – Weaned pigs

- 360 weaned pigs (26 d of age; iBW= 7,69 kg)
- 5 experimental groups – 12 replicates/trmt (6 pigs/rep)
- 5-week duration (Pre-starter, 0-14d; Starter, 14-35d PW)

	Treatment	Inclusion level SBM/PAP
1	Control	SBM inclusion: 10% (Pre-starter) or 14% (Starter)
2	PM- high ash	5% inclusion, replacing 7,5% SBM
3	PM- low ash	5% inclusion, replacing 7,5% SBM
4	Feather meal	4% inclusion, replacing 7,5% SBM
5	Po. Blood meal	4% inclusion, replacing 7,5% SBM

ADG and FCR (0-35d)



Follow-up study – Grow-Finishing pigs



	7-42 d		
	ADG	ADFI	FCR
	g/d	kg/d	g/g
Control	796	1.49	1.88
PM-High	798	1.49	1.87
PM-Low	822	1.51	1.85
Feather ml	799	1.47	1.84
LSD	70.2	0.088	0.093
SEM	23.2	0.029	0.031
<i>P</i> -value	0.85	0.78	0.74

Summary & Conclusions



- ◉ Weaned pigs:
 - Diets containing PM-Low had a similar growth performance to the control diet
 - Diets containing PM-High or Feather meal had a worse performance than the Control diet (with only SBM).

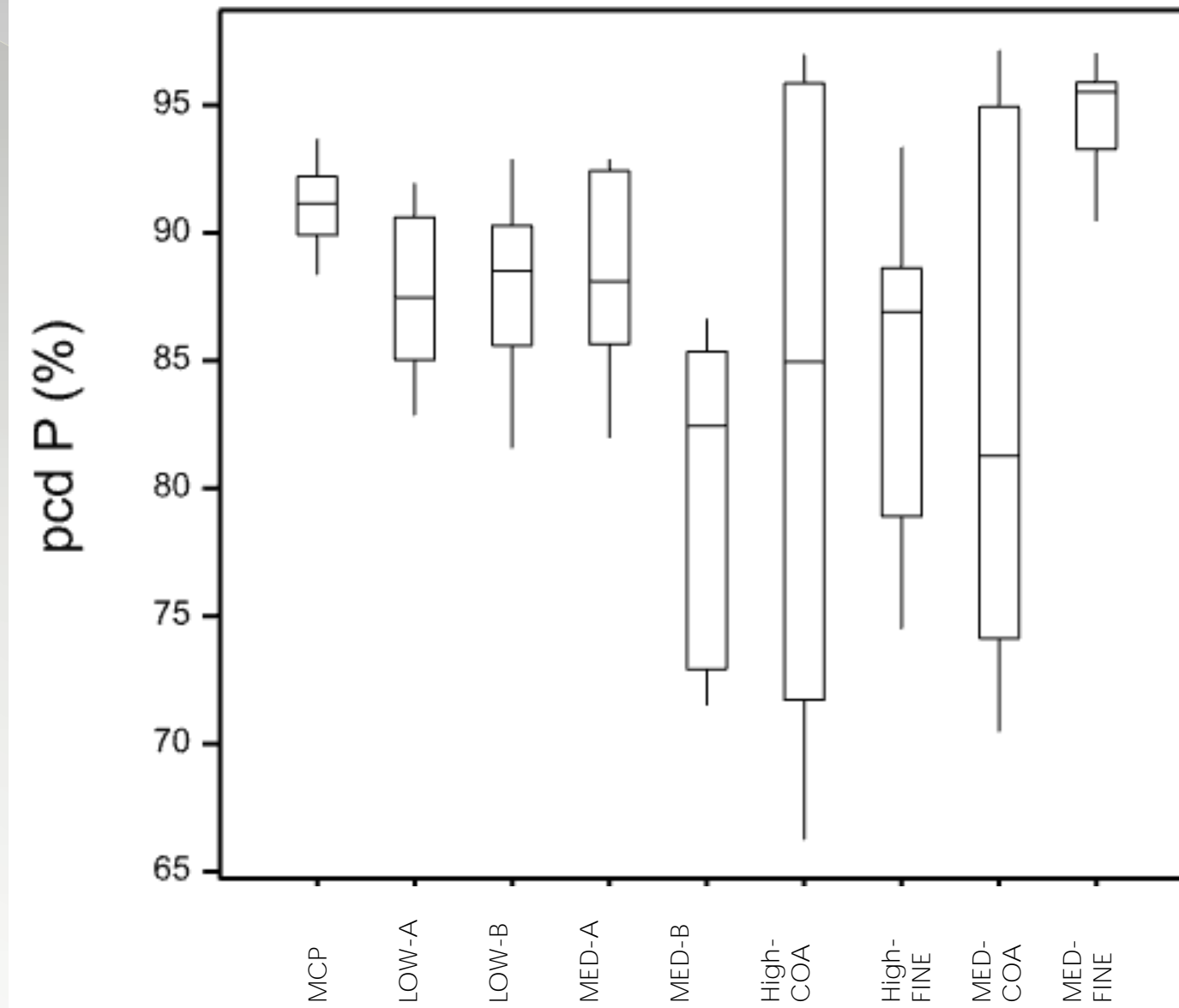
- ◉ Grow-Finishing pigs:
 - Diets containing PAPs performed similar to the control diet (with only SBM) when considering growth performance.
 - Diet compositions were based on the digestibility study data in pigs of similar age.

Broiler P digestibility trial



Test product	Method	Ash	Crude protein	Crude fat	Ca	P	Description
Mono calciumphosphate (MCP)	-	-	-	-	165	227	Inorganic phosphate
Porcine Meal, LOW-ash A	1	120	≥600	150	24	17	Rendering, mainly intestines
Porcine Meal LOW-ash B	7	120	≥600	150	24	17	Rendering, mainly intestines
Porcine Meal, MEDIUM-ash A	4	300	500	100	86	43	Rendering, carcass
Porcine Meal, MEDIUM-ash B	7	260	580	110	80	44	Rendering, carcass
Porcine Meal, HIGH-ash COARSE	7	450	430	90	150	76	Rendering, carcass
Porcine Meal, HIGH-ash FINE	7	450	430	90	150	76	Rendering, carcass
Porcine Meal, MEDIUM-ash COARSE	7	310	590	90	112	52	Bone protein/collagen, wet process, bone
Porcine Meal, MEDIUM-ash FINE	7	310	590	90	112	52	Bone protein/collagen, wet process, bone

P digestibility - broilers



Summary & Conclusions



- Pre-caecal (ileal) P digestibility varies between 80-94%; MCP 91%
- Processing method did not affect P digestibility
- Particle size: no significant difference on P digestibility, but coarser particles seem to give greater variation



Thank you for your attention

Webinar PPP

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Gemma Tacke
Wageningen University



Goal of the study



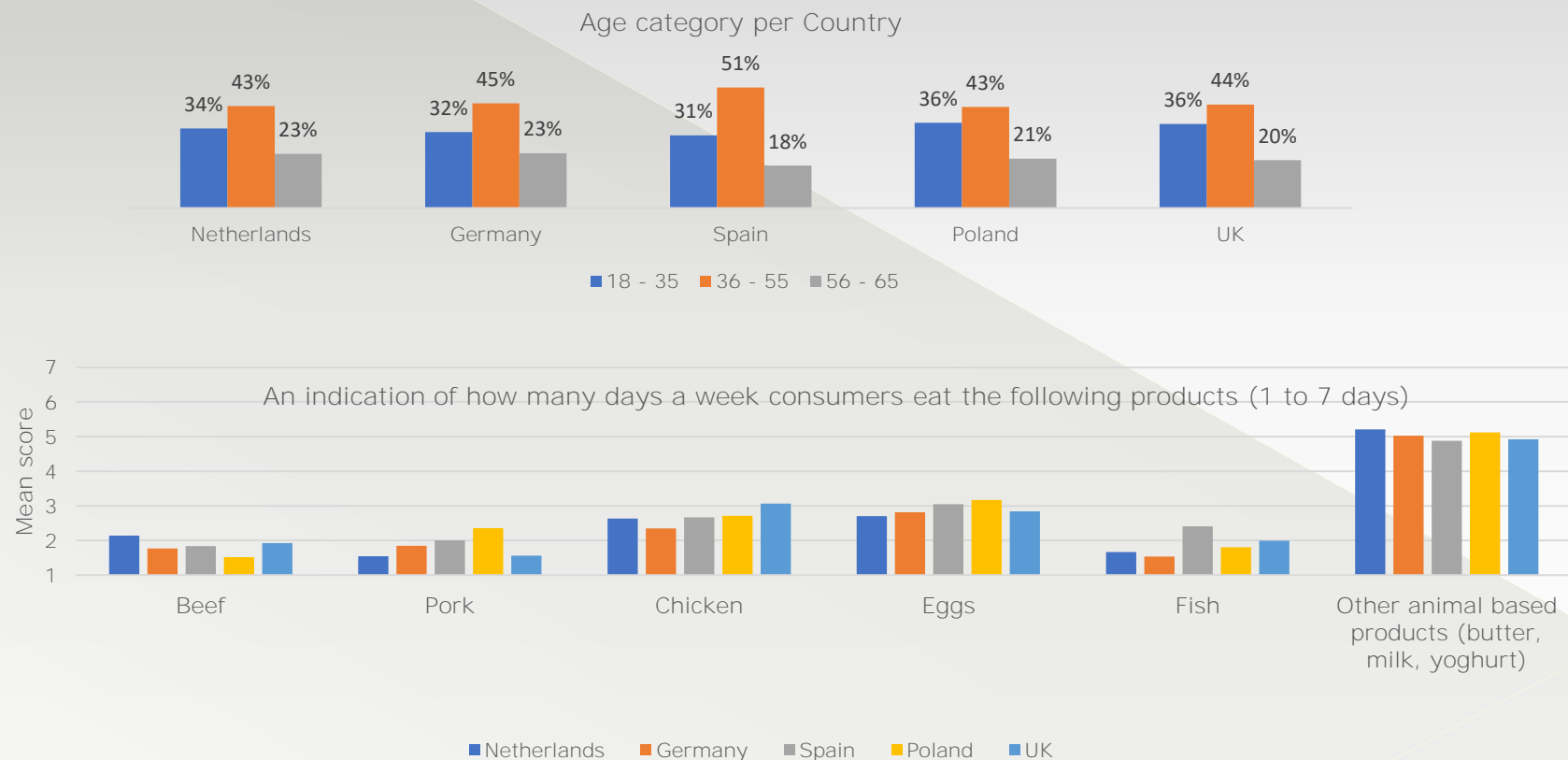
- The goal of this study was to gain insight in the awareness of consumers of the ingredients in animal feed and the acceptance of PAP's in animal feed in 5 countries: Germany, Netherlands, Spain, Poland, and United Kingdom.
- By studying this, results can be given about whether consumers care what ingredients are used in animals feed, what they find important about animal feed and which consumer groups can be identified. This gives stakeholders insights in acceptance of PAP's by consumers.



Demographics participants (1)

4974 participants in 5 countries participated.

In 4 countries slightly more women than men answered the survey. Only in Spain slightly more men than women answered.





Motives for purchasing food

In the table, the top 5 motives are shown. The number one motive is rated the highest (7-point scale, 1 = very unimportant, to 7 = very important)

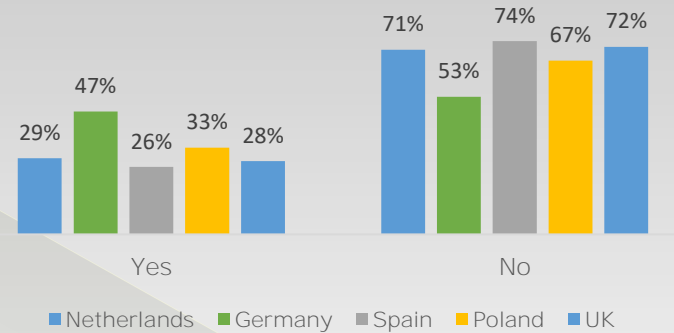
	Netherlands	Germany	Spain	Poland	UK
1	Tasty (6,04)	Tasty (6,21)	Tasty (5,85)	Tasty (6,11)	Tasty (6,14)
2	Affordable (5,66)	Healthy (5,51)	Healthy (5,79)	Healthy (5,83)	Affordable (5,72)
3	Healthy (5,51)	Natural (5,4)	Natural (5,54)	Provides me with pleasurable sensations (5,72)	Provides me with pleasurable sensations (5,51)
4	Provides me with pleasurable sensations (5,41)	Provides me with pleasurable sensations (5,32)	Provides me with pleasurable sensations (5,5)	Affordable (5,69)	Healthy (5,29)
5	Is convenient (5,02)	Animal friendly (5,25)	Affordable (5,47)	Natural (5,58)	Is convenient (5,26)

Participants knowledge of animal feed

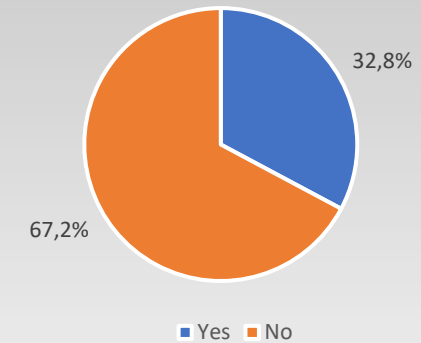


German and Polish consumers claim to know a lot about feed, but when talking about by-products they become more modest.

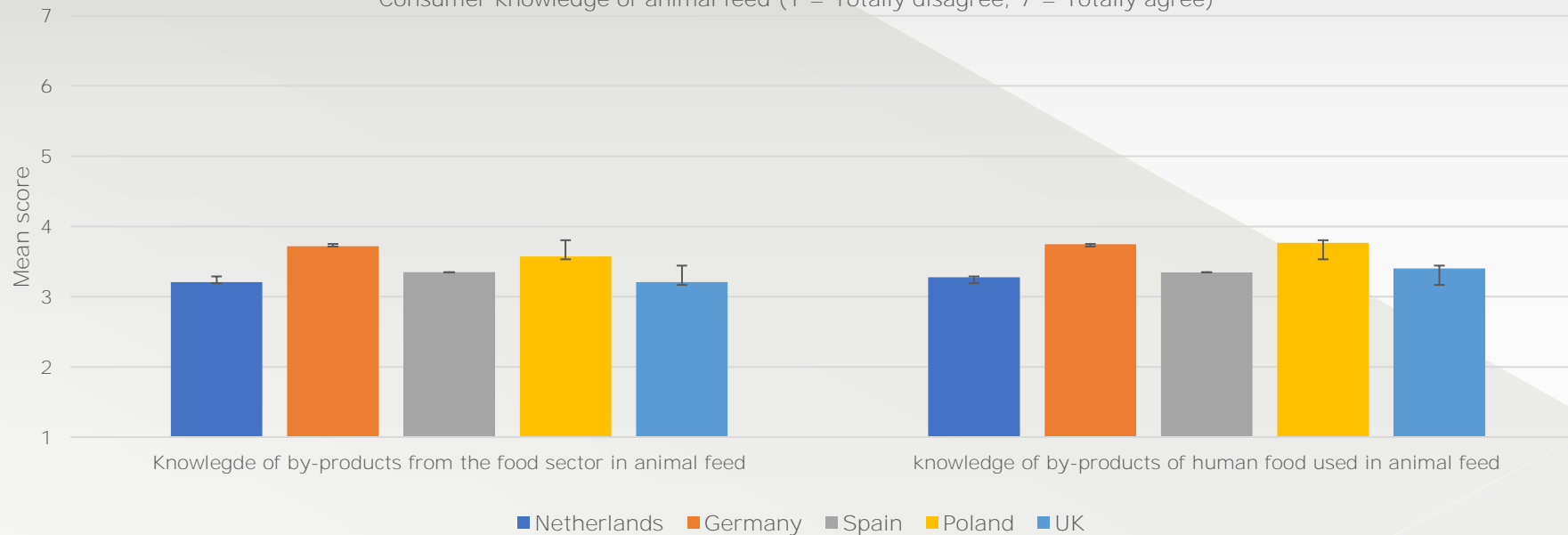
Do you have any idea of which ingredients are in animal feed for pigs and chicken?



For all countries



Consumer knowledge of animal feed (1 = Totally disagree, 7 = Totally agree)



Associations of good quality feed (open question) (1)

Netherlands



Germany



UK

What shouldn't be in feed of pigs (multiple choice)?



	Netherlands	Germany	Spain	Poland	UK	All countries
1	Genetically modified organisms (46%)	Genetically modified organisms (63%)	Genetically modified organisms (53%)	Genetically modified organisms (62%)	Genetically modified organisms (40%)	Genetically modified organisms (53%)
2	Preventive medication (37%)	Preventive medication (55%)	Curative medication (38%)	Insects (48%)	Animal proteins (24%)	Preventive medication (37%)
3	Curative medication (36%)	Curative medication (44%)	Preventive medication (38%)	Curative medication (44%)	Insects (22%)	Curative medication (36%)
4	Insects (17%)	Animal proteins (27%)	Animal proteins (33%)	Preventive medication (36%)	Don't know (22%)	Insects (27%)
5	Don't know (13%)	Insects (23%)	Insects (27%)	Animal proteins (27%)	Preventive medication (20%)	Animal proteins (25%)

What shouldn't be in feed of chicken (multiple choice)?

	Netherlands	Germany	Spain	Poland	UK	All countries
1	Genetically modified organisms (43%)	Genetically modified organisms (63%)	Genetically modified organisms (52%)	Genetically modified organisms (60%)	Genetically modified organisms (38%)	Genetically modified organisms (51%)
2	Preventive medication (36%)	Preventive medication (54%)	Preventive medication (40%)	Curative medication (40%)	Animal proteins (26%)	Preventive medication (37%)
3	Curative medication (33%)	Curative medication (43%)	Animal proteins (36%)	Insects (39%)	Don't know (22%)	Curative medication (34%)
4	<i>Animal proteins</i> (16%)	<i>Animal proteins</i> (28%)	Curative medication (35%)	Preventive medication (37%)	Insects (20%)	Animal proteins (27%)
5	Don't know (15%)	Insects (18%)	Insects (22%)	Animal proteins (28%)	Preventive medication (18%)	Insects (23%)

Message 1 - Information about animal proteins in animal feed

Pigs and chicken are omnivores by nature, which means they eat plants and other animals. In nature, for example, pigs eat small animals in combination with carrots, seeds and nuts. In nature, chicken eat plants, fruit and especially insects, worms, and sometimes other small animals.

Although chicken and pigs are not vegetarian by nature, on EU farms they only receive plant-based feed nowadays. Feeding animal proteins is not allowed. Besides unnatural, feeding pigs and chicken exclusively with only plant-based feed is not circular. Feeding pigs and chicken with animal proteins made of slaughter by-products (from other animal species) would contribute to the efficiency of the meat production system. In addition, it is more sustainable to feed animals with animal proteins than exclusively vegetarian diets. This is because it allows to reduce the import and use of plant-based feed ingredients like soybeans.

Recently, an improved animal feed ingredient has been developed based on animal protein, to meet all food safety standards. How this ingredient is processed is explained in the next section.

These animal proteins are made of the carcasses and other parts of slaughtered animals, that are fit for human consumption but not preferred by consumers. When slaughtering animals, everything is first processed for consumer use. However, certain parts of the animal are not suitable for human consumption, such as feathers and bones. Other parts are hardly bought by consumers, such as blood and intestines. Nevertheless, these parts contain valuable nutrients, such as proteins, fats and minerals.

These parts that consumers do not eat are first properly heated and dried to ensure safety for animals and consumers. These are then mixed with plant-based ingredients into feed for pigs and chicken. This allows animals to eat vegetable and animal proteins in a healthy and more sustainable way.

Message 2 - Livestock receive animal proteins for feed

In 2001, feeding animal proteins to all farm animals was banned in the EU due to BSE (mad cow disease). Although BSE did not affect pigs and chicken, all animal proteins used in feed for food were banned, because measuring methods couldn't identify the source of animal proteins, and therefore control institutions couldn't guarantee whether animal proteins contained proteins originating from cows. Since this ban, all farm animals have been fed with plant-based diets, despite the fact that pigs and chicken are omnivores.

Because of these regulations, since 2001 by-products from slaughterhouses have been processed, cooked and used for non-food applications (e.g. fertilizers and pet food). Using these by-products or animal proteins for animal feed would be much better for the environment and the animal.

That is why feed companies and the European Parliament have proposed that animal proteins should be reused as an animal feed ingredient for chicken and pigs.

According to leading animal feed companies, these new animal proteins are good and healthy proteins. Today's animal feed proteins only come from healthy slaughtered animals. In addition, they are produced safely (high temperature) without risks to human health and due to improved detection technology nowadays animal proteins in feed can be efficiently analyzed to trace back from which animal they originate.

Therefore it is completely safe to feed pigs and chicken with animal based proteins.

Feelings of fear, persuasiveness, and acceptance across five countries due to the texts



Country	Fear	Persuasiveness	Acceptance
Germany	3.32 (1.55) ^{a,b}	4.76 (1.26) ^a	3.67 (1.63) ^a
Netherlands	3.12 (1.53) ^a	4.82 (1.16) ^a	4.09 (1.59) ^c
Poland	3.10 (1.63) ^a	4.78 (1.27) ^a	3.85 (1.58) ^{a,b}
Spain	3.38 (1.65) ^b	4.80 (1.32) ^a	3.78 (1.65) ^{a,b}
UK	3.34 (1.67) ^{a,b}	4.84 (1.24) ^a	3.93 (1.62) ^{b,c}

Note. the alphabetical order of the superscripts represents the ascending order of the significantly different means following Tukey's HSD test (all p values < 0.01).

Conclusions (1)



- Participants from all countries have low knowledge of what ingredients are of animal feed
- In general ingredients should be natural, healthy and plant-based
- Consumers would like to see product labelling of feed ingredients, especially in case of changes
- In product choice taste, price and healthiness are leading. In the choice experiment the diet of the animal was leading (100% plant-based was preferred). However the special attention for this subject in the questionnaire might be of influence.

Conclusions (2)



In absolute terms:

- 'Neutral consumers' and 'consumers who think that animal proteins are acceptable', message 1 and 2 score nearly the same
- For most countries, 'consumers that consider feeding with animal proteins unacceptable' think that message 2 is worse on content than message 1.
- For 'consumers that accept animal proteins in feed', the differences are smaller, but slightly in favour of message 1

Conclusions (3)



- ◉ Fear for PAP's is significantly higher in Spain, but absolute still slightly above moderate
- ◉ Consumers, who are more ecologically friendly and/or believe that they have knowledge about feeding practices, also show more fear for PAP's
- ◉ Fear for their own health increases fear for PAP's
- ◉ The persuasiveness of messages outperforms the fear
- ◉ In 4 out of the 5 countries, females show a lower acceptance rate than male respondents
- ◉ No large differences in acceptance of PAP's between countries, apart from fear in Spain

Recommendations



- ◉ For each country tailor made messages
- ◉ Take message 1 as a base and rewrite towards their ideas.
- ◉ Take into consideration that consumers that do not accept animal proteins have a different reasoning than consumers that accept animal proteins.
- ◉ Involve non-activist **NGO's** in the communication.

Thank you very much for your attention

More information
gemma.tacken@wur.nl



Webinar PPP

Circular Bio Economy

Increasing circularity in
animal feed: practical results
January 31, 2023

Martin de Groot
Bonda



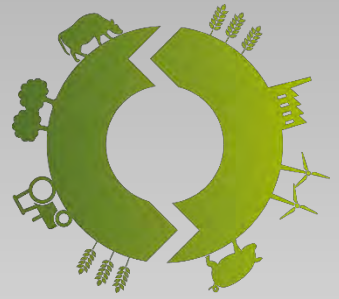


Wet co-products

Martin de Groot
Bonda - Agrifirm



Introduction



- Goal: improve the possibilities of wet co-products in feed

1. Optimize the composition of co-products by demineralisation



2. Adding wet co-products in dry compound feed



Demineralisation



Actual situation



- Wet co-products are very sustainable with a low carbon footprint
- Content of minerals limits the possibilities of some co-products in feed

For example:



- protein
- carbon hydrates



- Minerals
Na, K, P, SO₄

Selected products



brewers spent grains



DGS

(distillers grains and solubles)



whey permeate



corn steep liquor (CSL)

Selected products



Product	Industry	Form	Rich in	Further processing
Corn steep liquor (CSL)	Starch	Liquid	Protein	Extract minerals, such as P, Na, K
Brewers spent grain	Brewery	Stackable	Protein fibre	Extract minerals, such as P
DGS (distillers grains and solubles)	Fermentation	Liquid	Protein	Extract minerals, such as P, Na, K, S
Whey permeate	Dairy	Liquid	Lactose	Extract minerals, such as Na, K, Cl, S



Separation techniques



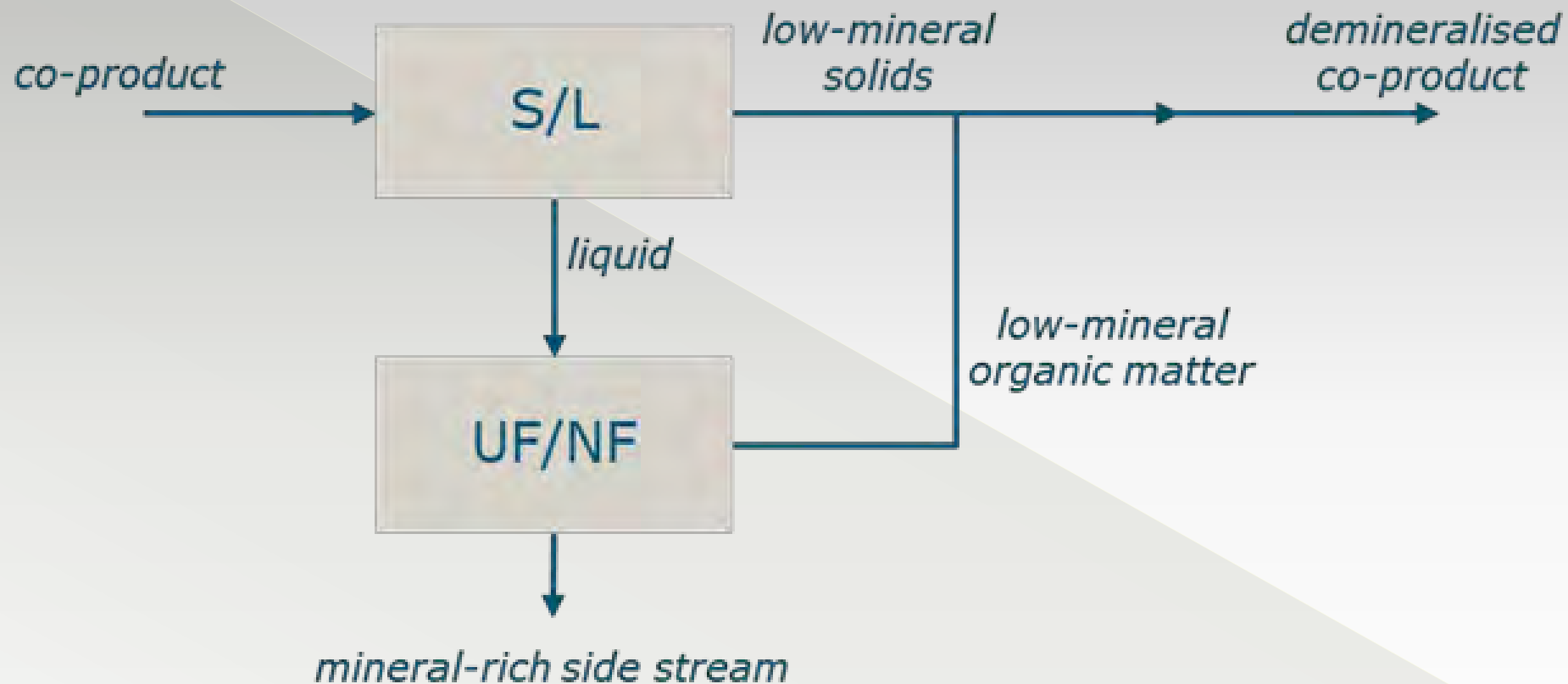
Product	Possible Separation techniques
Corn steep liquor	Flocculation Centrifugation Filtration
Brewer spent grain	Extraction
Distillers grains solubles (DGS)	Centrifugation Nanofiltration
Whey permeate	Flocculation Liquid phase treatment by ion exchange

Separation techniques



Product	Possible Separation techniques
Corn steep liquor	Flocculation Centrifugation Filtration
Brewer spent grain	Extraction
Distillers grains solubles (DGS)	Centrifugation Nanofiltration
Whey permeate	Flocculation Liquid phase treatment by ion exchange

Principle



Results



- In a combination of centrifugation and filtration it is possible to reduce minerals
- DGS
 - > 34% PO_4 removal
 - > 37% AS- PO_4 removal
- Corn steep liquor
 - > 12% PO_4 removal
 - > 82% AS- PO_4 removal

Cost



- € 170 - € 200 per ton dry matter
- Sum of costs for labour, decanter and filtration

Conclusions

- ◉ Technical possible
- ◉ High costs
- ◉ Chances with higher inclusion in rations
- ◉ Challenge for the high mineral sidestream





Wet co-products in dry compound feed



Use of wet co-products in pellets for piglets



- How much of a wet co-product can we add in a pelleted feed?
- What is the effect on the quality of the pellets?
- What is the effect on the preservation of the feed?
- What is the effect on performance of piglets fed these pellets?

Co-products



- Two different wet co-products tested in dry pelleted pig feeds
 - > Whey permeate 28% DM:
 - Thin liquid
 - Cold
 - Sugery
 - > DGS 24% DM:
 - Thick liquid
 - Warm
 - Protein



Pelleting experiments

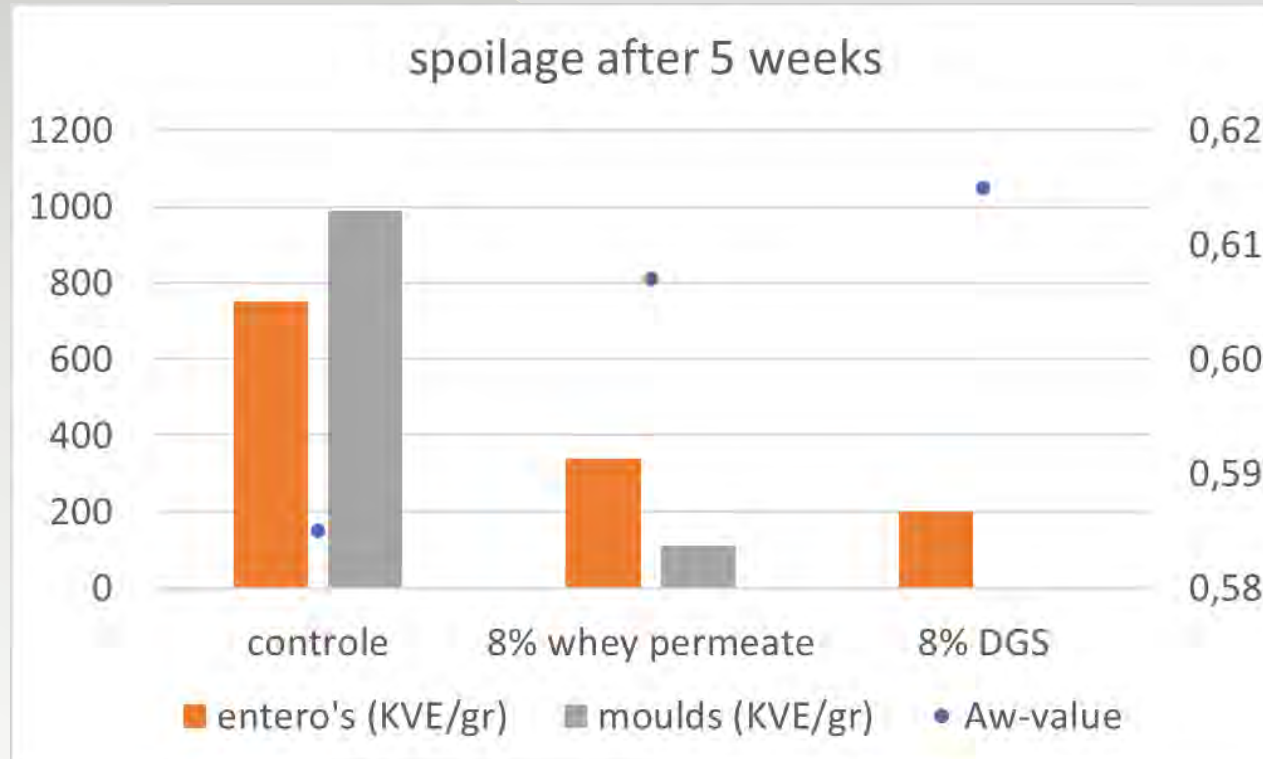


1. Adding the wet co-products directly in the conditioner and pelletize to pellet
 2. Adding the wet co-products directly in the conditioner, expand and pelletize to pellet
- ◉ Dosing increased up to 8%
 - ◉ Moisture, AW-value, pellet quality, preservation of the pellets

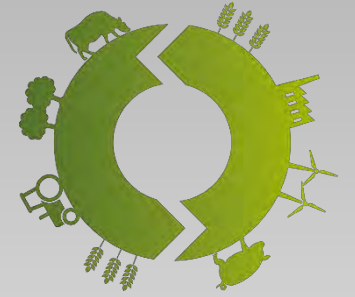
Results pelleting experiments



- After 5 weeks mimicking feed silo conditions:
- Less yeasts, moulds and entero bacteria



Results pelleting experiments



- ◉ Flowability of pellets with increased moisture
- ◉ Lab test compacting feed
- ◉ feed with 8% wet co-products showed lumps



Experimental feed production



- ◉ 6 piglet feeds produced:
 - > Control feed no water
 - > Dosing 6% dry Grass protein
 - > Control feed dosing 6% water in conditioner
 - > Dosing 8% wet DGS
 - > Dosing 7% wet Whey permeate
 - > Dosing 8% wet Grass protein

Analysis pelleted feeds



	treatment	Hardness (N)	Durability (%)	AW value	pH in feed
1	Control Dry	57	90,5	0,59	5,51
2	CD+ 6% dry grass protein	59	92,0	0,60	5,34
3	Control Wet: 6% water	43	94,5	0,76	5,38
4	CW+ 8% DGS	49	94,0	0,73	5,26
5	CW+ 7% Whey permeate	50	94,5	0,73	5,39
6	CW+ 8% wet grass protein	48	94,5	0,75	5,32

Piglet experiment



- ◉ 12 replicates per treatment
- ◉ Start at weaning (8.1 kg BW): all treatments fed the same commercial weaner feed
- ◉ At 14 days after weaning (10.7-11 kg BW): experimental feeds until 35 days fed (21.1-22.5 kg BW)
- ◉ Normal losses and normal manure scores found

Results piglet experiment (2)



Day 14-35 experimental feeds

	Treatment	ADG COVA	ADFI DM COVA	FCR DM	FCR DM COVA
1	Control Dry	520 ab	653	1.26 b	1.26 b
2	CD+6% dry grass protein	503 a	636	1.26 b	1.27 b
3	Control Wet	545 b	645	1.20 a	1.19 a
4	CW+8% DGS	506 a	637	1.26 b	1.26 b
5	CW+7% Whey permeate	522 ab	658	1.27 b	1.27 b
6	CW+8% wet grass protein	498 a	646	1.30 c	1.30 c

Results piglet experiment (3)



● Day 1-35 total experiment

	Treatment	ADG (g/a/day)	ADFI DM (g/a/day)	FCR	FCR DM
1	Control Dry	385 ab	478	1.40 a	1.24 b
2	CD+6% dry grass protein	372 a	466	1.41 ab	1.25 b
3	Control Wet	412 c	491	1.40 a	1.19 a
4	CW+8% DGS	381 ab	476	1.46 c	1.25 b
5	CW+7% Whey permeate	401 bc	497	1.44 bc	1.24 b
6	CW+8% wet grass protein	380 ab	481	1.46 c	1.27 b

Conclusions



- Producing feed with wet co-products is possible: use expander before pelleting
- Pellet quality and preservation are good
- Piglets perform well
- No health problems in this experiment

Webinar PPP

Circular Bio Economy

Increasing circularity in
animal feed: practical results
January 31, 2023

Ellen van Eerden
Schothorst Feed Research





Processing of novel proteins and use in broiler diets

Ellen van Eerden

Sub-projects in WP FEED



- ◉ Sub-project: Valorization legumes
- ◉ Sub-project: Refining grass and green leaves
- ◉ Aim: to investigate technological possibilities to increase the use of circular and/or regional feedstuffs, such as protein from legumes, grass, and green leaves for use in monogastrics

Legumes



- Legumes contain reasonable amounts of protein, but not to the same extent as soybean meal (SBM)

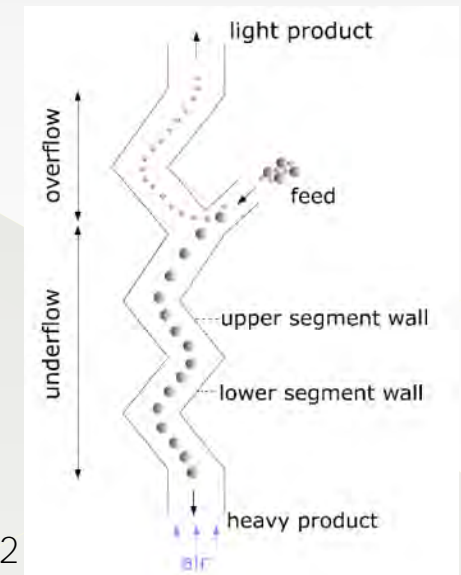
Raw material (CVB, 2022)	Protein content (%)
SBM	48
Faba beans (ensiled)	16
Peas	20
Lupins	36

- Higher protein content may increase the possibilities to use legumes in broiler and pig diets
- Air classification: technological method to concentrate protein

Principle of air classification



- Air classifier: zigzag shaped tube(s), arranged on a wheel rotating around its axis
- Centrifugal force due to the rotation of the classifier
- Air flow separates heavy and light particles
- Separation process determined (a.o.) by air volume and classifier speed
 - Fine milling of the raw material is required
 - Heavy particles: starch-rich fraction
 - Light particles: protein-rich fraction
- Study with lupins and faba beans

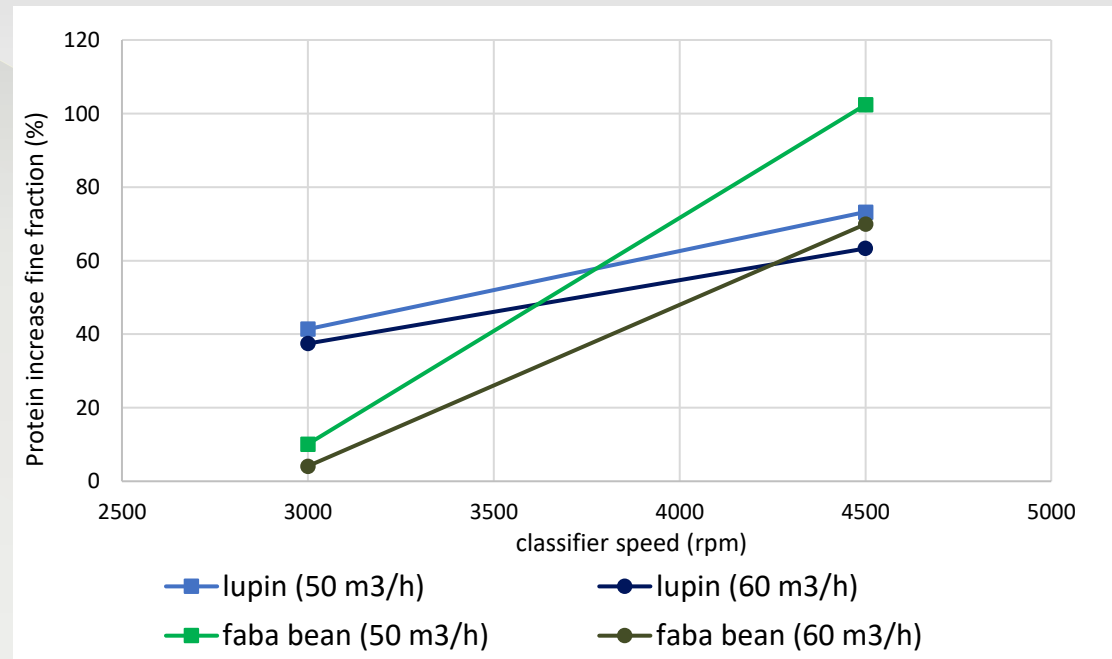
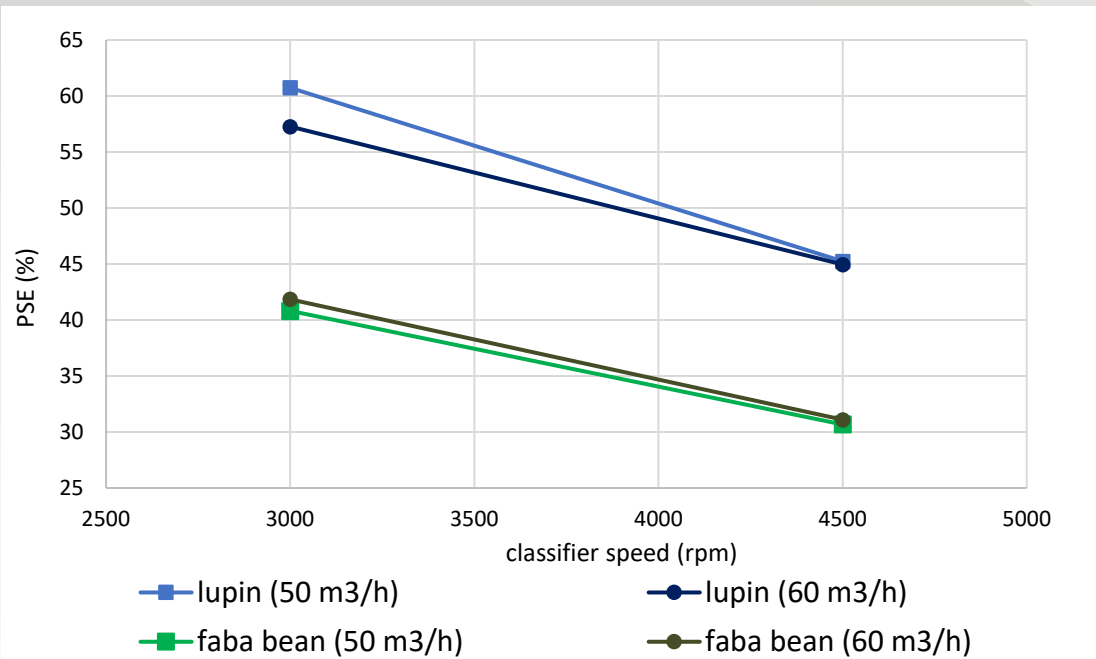


Faba bean fractions after air classification



Results

- Higher Protein Separation Efficiency (PSE) for lupins than for faba beans
- Air volume hardly affected the results for PSE
- Lower PSE, but higher protein increase with 4500 rpm classifier speed

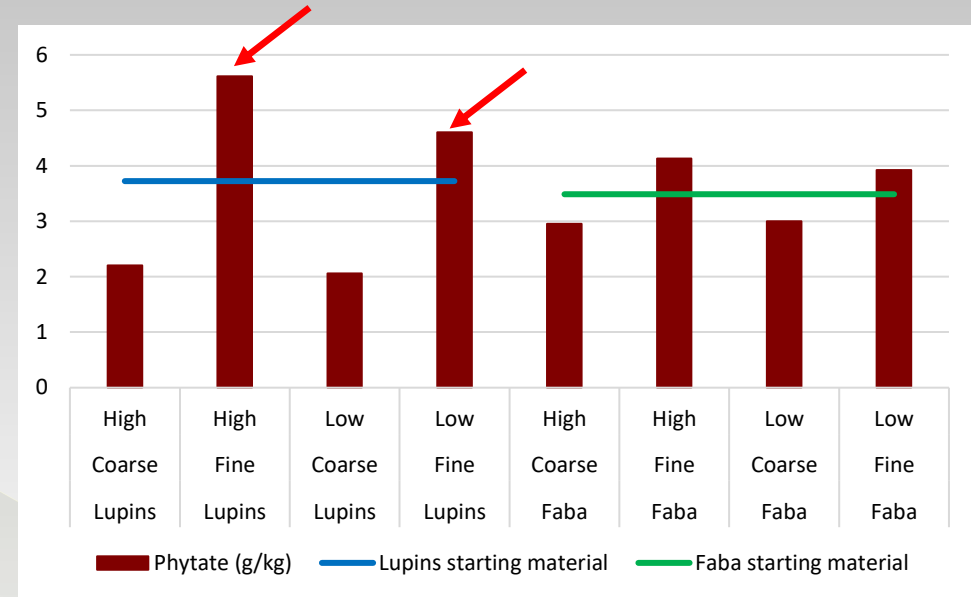
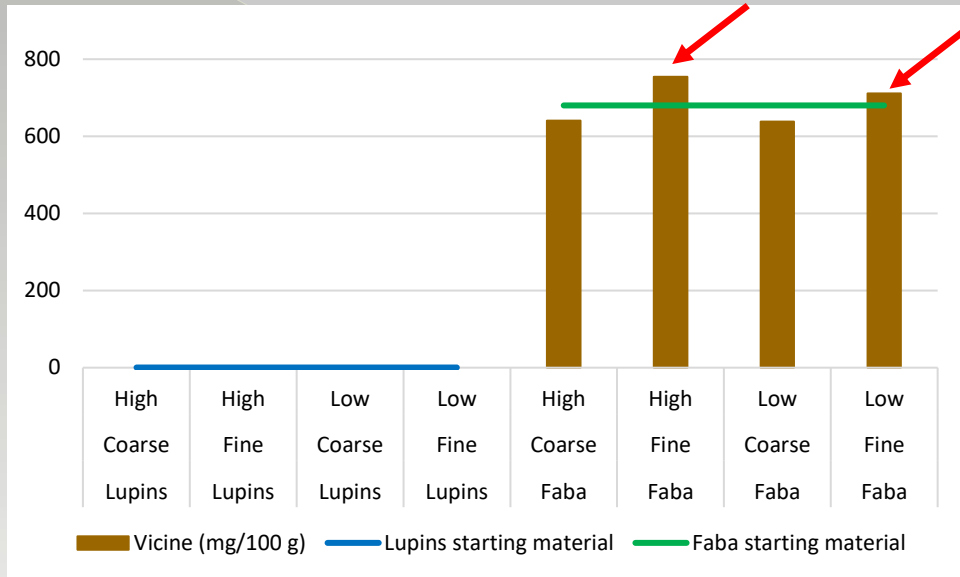


Potential problem: ANFs...



- Literature: ANFs tend to accumulate in the fine fraction
- Follow-up study: selection of settings with high and low protein increase in fine fraction
 - > High protein increase → 4500 rpm classifier speed
 - > Low protein increase → 3000 rpm classifier speed
 - > Air volume 50 m³/h for both classifier speeds
- Analysis on vicine, convicine, lectins, and phytate

Results ANF analysis



- Faba beans: accumulation of all four tested ANFs in the fine fraction
- Lupins: undetectable levels of vicine and convicine, and very low levels of lectins, but accumulation of phytate in the fine fraction
- In general: maximizing protein increase in fine fraction \approx maximizing ANFs in fine fraction

Protein from grass/green leaves



- Protein isolate from grass as a novel protein source
- Lucerne (alfalfa) and red clover protein paste



Analyses protein isolates grass/leaves

		Lucerne	Red clover	Grass isolates	
				Supplier A	Supplier B
Original plant					
DM	%	17.8	13.7		
N	%	4.6	3.1		
ash	%	10.3	10.7		
Protein paste before freeze-drying					
DM	%	29.8	26.5		
N	%	9.4	8.3		
ash	%	6.3	6.3		
After freeze-drying					
Moisture	g/kg	7	5	28	20
Ash	g/kg	62	69	73	105
Crude protein	g/kg	581	500	424	442
Crude fat (AH)	g/kg	128	118	102	131
Crude fiber	g/kg	20	36	13	44
In vitro digestibility					
Crude protein	%	79	60	84	77
Organic matter	%	72	44	78	65

Digestibility trial with broilers



- ◉ Aim: to determine feeding values of alternative (commercially available) protein sources with SBM as a reference
- ◉ Pre-experimental phase from D0-14 with a standard diet
- ◉ Experimental diets fed from D14-24
- ◉ Collection of excreta D21-22-23
- ◉ Collection ileal digesta on D24
- ◉ Production performance D14-24

Treatment schedule



Treatment	Description	Inclusion level (%)
1	Basal feed	---
2	Basal feed + SBM	20
3	Basal feed + grass protein isolate	22
4	Basal feed + insect protein A	18
5	Basal feed + insect protein B	18
6	Basal feed + pea protein concentrate	18
7	Basal feed + faba bean protein concentrate	16

Fecal digestibility (dietary level)



Trt	Description	dc CP	dc FAtH	dc CF	dc NFE
1	Basal feed	85.4 ^e	81.3 ^{bc}	-1.3 ^a	76.7 ^e
2	SBM	85.2 ^{de}	79.5 ^b	2.3 ^{abc}	68.8 ^b
3	Grass protein isolate	72.3 ^a	49.3 ^a	6.2 ^c	67.8 ^a
4	Insect protein A	82.2 ^c	83.4 ^{cd}	5.5 ^{bc}	73.8 ^d
5	Insect protein B	79.8 ^b	82.3 ^{cd}	3.2 ^{bc}	72.7 ^c
6	Pea protein concentrate	84.7 ^d	84.0 ^d	1.3 ^{ab}	72.7 ^c
7	Faba bean protein concentrate	85.1 ^{de}	83.8 ^d	1.3 ^{ab}	73.2 ^{cd}
	P value	<0.001	<0.001	0.023	<0.001
	LSD	0.77	2.29	4.67	0.67

Ileal digestibility (dietary level)



Trt	Description	dc CP		dc SUM 17AA		dc Lys	
1	Basal feed	72.9 c		75.1 bc		78.0 c	
2	SBM	72.5 c		76.2 c		79.3 c	
3	Grass protein isolate	55.1 a		61.7 a		66.3 a	
4	Insect protein A	68.3 b		74.7 bc		77.2 c	
5	Insect protein B	66.7 b		72.2 b		73.5 b	
6	Pea protein concentrate	77.7 d		80.1 d		83.4 d	
7	Faba bean protein concentrate	77.8 d		80.4 d		83.9 d	
	P value	<0.001		<0.001		<0.001	
	LSD	2.40		3.30		2.53	

Conclusions



- Based on nutritional values, legume protein concentrates and insect proteins are interesting, but expensive alternatives for SBM
- Accumulation of ANFs in protein-rich fractions of air-classified faba beans and lupins
- No negative effects on digestibility or performance in the commercial pea and faba bean protein concentrates
- Nutritional value of the grass protein isolate used in this trial was low, which was probably related to the processing method

Thank you for your attention!

EvEerden@schothorst.nl



Webinar PPP

Circular Bio Economy

Increasing circularity in
animal feed: practical results
January 31, 2023

Sharon van Schaijk
AgruniekRijnvallei



Introduction



- ◉ Motivation: Search for suitable products and a major innovation challenge for residual flows and by-products from biobased and food industry.
- ◉ Goal:
 - Getting clarity of some concepts, like circularity.
 - Screening the applicability and/or bottlenecks for the use of products in the feed industry.

Circularity of animal feed stuffs

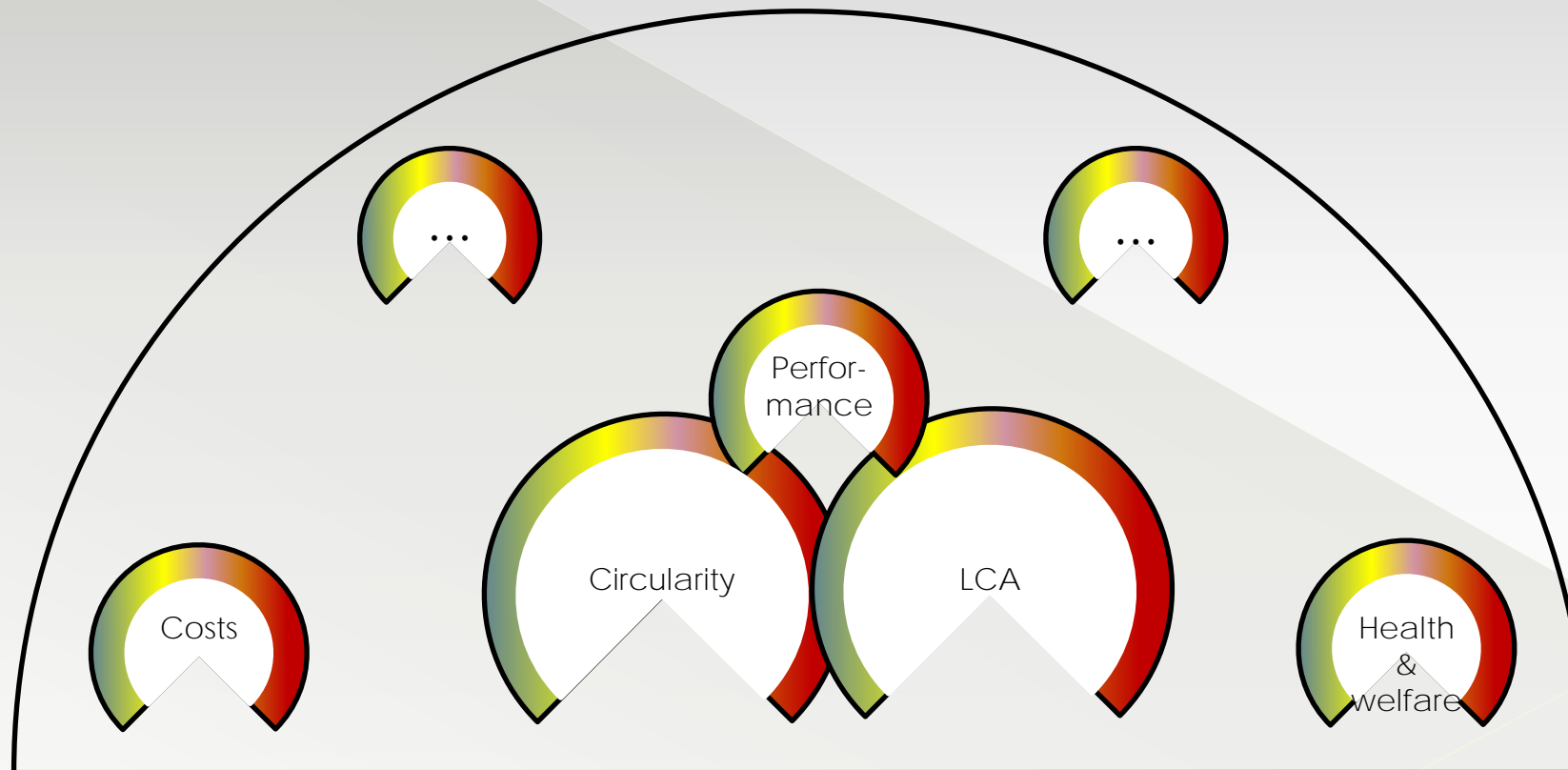


- KringloopToets
- Collaboration of 3 private public partnerships (PPP)
 - > Feed4Foodure
 - > Vitale Varkenshouderij
 - > Circular Bio-Economy
- Definition to capture the circularity of animal feed
- Workshop sessions
 - > 3 researchers from the PPP's
 - > 5 practical experts from different parts of the animal feed chain
 - > 4 practical experts from the primary sector (pig, poultry, dairy and arable farming)
 - > 2 policy makers (LNV)
 - > 2 experts from internationally oriented environmental organisations

Circularity of animal feed is one of the key performance indicators (KPI) on the sustainability dashboard



- Partly with overlapping criteria
- Partly independent from others KPI's



Bottleneck



- ◉ Technical and nutritional review for applicability of known residual flows from the food industry.
- ◉ Which tools and questions are necessary to measure applicability

Question: Can we develop a tool to help animal feed sector and suppliers of residual flows to assess whether products are (or can become) suitable for inclusion in animal feed?

Screeningtool



- ◉ Goal: screeningstool for new feed materials
 - > Legal aspects
 - > Safety
 - > Quality
- ◉ Target group:
 - > Talking piece to indicate within and outside the sector
 - > Detailed form for users (nutritionist, purchasers, suppliers)

Key points of the screening-tool



Origin

Logistics and
availability

Technical
properties

Nutritional
properties

ESG

Economics

Feed safety and
legislation

Upgrade



- ◉ Tool discussed with:
 - > Nevedi
 - > Bemefa
 - > Article in the Molenaar
- ◉ Available for everyone
 - > Accessible via: [Producten PPS Circulaire Bio-economie - WUR](#)

A completed form(Example)



Key Point	Questions	Answers / remarks
Origin	What is the name and legal name of the product?	Grass protein obtained by refining fresh grass
	From which industry does the product come?	Agriculture
	What is the origin of the product?	Harvesting (mowing + picking up), bruising, pressing, coagulating, decanting, possibly. Drying and storing grass protein. The protein in grass juice is heated and/or added organic acids coagulated and separated by decanting. The grass juice is obtained by bruising and mechanically pressing fresh grass.
	Who is the supplier?	-
	From which area does the product originate and how is this guaranteed?	Areas where there are surpluses of fresh grass
	To what detail can the product be traced and how is this guaranteed?	Unknown; is not reported on FSDS.
	Other comments? Partial conclusion?	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Supply and availability	How much product is available on an annual basis?	Unknown. Depends on multiple factors
	What is the frequency of availability?	Depending on the growing season of grass.
	How long will the product remain available for the desired use?	At least 6 months in dry and moisture-rich form
	Does the supplier have a strategic interest in another sales channel in the long term? If so, how is this risk mitigated?	Sales for food is mentioned. It is expected that most of the product will be intended for animal feed.
	Other comments? <i>Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Technical properties	Can the product be stored in the desired production facility (use e.g. MSDS/FSDS/TDS)? (Think of shelf life, preservation, appearance, temperature, acidity, running characteristics, etc.)	Yes
	Can the product be processed in the desired production facility (use e.g. MSDS/FSDS/TDS)? (Think of particle size, moisture content, contamination risk and grinding and pressing capacity)	Yes
	Other comments? <i>Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Nutritional properties	Determine (e.g. on the basis of the PDS, production method and (animal feed) analyses) whether similar products are present in raw material databases (e.g. CVB). What are similar raw materials? In which group of raw materials does the product fall?	This information is will be shared by supplier.
	In which animal groups can the product be used?	All animals
	What is the shadow price (or bandwidth) of the product and for which animal category?	Unknown. There is no sales price available yet
	Other comments? <i>Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
ESG-criteria (environmental, social, governance Read more.	Does the product contain certificates that are in the interest of ESG? If so, which ones?	Producer response: A GMP+ certificate is available.
	Does the product (or semi-finished products) come from ESG-critical regions? If so, motivate why.	No. Basic raw material is fresh surplus grass.
	Is there a risk of displacement of arable land that is also suitable for growing human-edible protein?	Yes
	If the above question is yes, what demonstrable steps does the supplier take to avoid this ESG risk?	Unknown is the current phase of the project.
	<i>Other comments? Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Economy	What is the price of the product?	Unknown
	How does pricing take place?	Unknown
	How volatile is the price (describe and/or give an index, e.g. β coefficient)	Unknown
	With which commodities does the price move with it?	Protein market
	Can the product be hedged?	Unknown
	Other comments? <i>Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Food safety and legislation	Is GMP+ certification available for the product? What is the registration number? Click here for GMP database.	Yes, Moisture-rich grass protein
	Is SecureFeed certification available for the product? Click here for SF database (not public).	No
	Does the product comply with (any) local legislation?	-
	If necessary, does the product meet non-statutory (chain) requirements (e.g. SKAL, GMO-free, soy-free)? Which relevant certificates are available?	No
	<i>Other comments? Partial conclusion?</i>	-

A completed form(Example)



Key Point	Questions	Answers / remarks
Upgrade	Is it better to bring the product to value (possibly in another application) in animal feed? If so, what is needed for this?	Yes, pet food and fish food
	How can any negatives from the list above be removed? See also the <u>R-ladder</u> .	-
	Other comments? Partial conclusion?	-



Thank you for your attention!

Discussion and questions

Webinar PPP

Circular Bio Economy

Increasing circularity in
animal feed: practical results
January 31, 2023

Gert van Duinkerken
Wageningen Livestock Research

