Sustainable feed ingredients

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Abstract

There is no definition of sustainable feed ingredients as such. Nevertheless rendered products have the potential to be considered 'sustainable'. Not only when produced in a responsible way but also when the potential positive effects upstream (i.e. preventing waste from slaughterhouses) and downstream (i.e. rendered products as feed ingredients for sustainable animal production) in the value chain are taken into account. The process of making sustainability operational requires a few steps. Principles and criteria need to be established in multi-stakeholder platforms, methodology needs to be developed and harmonized, and high quality data needs to be generated and made publically available. Only when complying with these 'prerequisites', credible and trustworthy communication can be started by the rendering industry both towards value chain partners, consumers and society. Together with the high sustainability potential of rendered products, it will also open the door for value creation in markets where sustainability has become a priority.

Introduction

The global demand for animal products (meat, eggs, dairy products and fish) is increasing, driven by growing populations, urbanization and raising incomes. The challenge is to meet this global growing demand in a sustainable way, taking into account the limited availability of resources and the need to reduce the pressure on the environment. The contribution of animal feed to the footprint of animal products is significant, both because of the cultivation, transport and processing of the ingredients, and the effects at the livestock farm. Therefore it is important to focus on feed ingredients. In this article it is discussed what is meant by “sustainable” in relation to feed ingredients and what initiatives are currently running in the global feed industry to encourage the use of sustainable ingredients. Moreover, a special focus is on rendered products, in particular the requirements to demonstrate that rendered products comply with definitions of sustainable ingredients. Potential advantages of marketing sustainable rendered products and of using rendered products for sustainable animal production are given.

Definition of sustainable feed ingredients

The concepts of sustainability and sustainable development are complex and there is no consensus about how to apply them in practice. One single and comprehensive package of sustainability criteria and indicators does not exist, because sustainability is determined by (individual) perceptions, backgrounds, interests and developments of people and their environment. As a result, there is no definition of sustainable feed ingredients. To deal with this problem and to include opinions of different interest groups in the process of making sustainability operational, multi-stakeholder platforms, uniting producers, traders, processors and NGOs have been established to set principles and criteria that production will have to meet in order to be termed ‘responsible’. In general the criteria are selected according to the economic, societal and ecological dimensions of sustainability. Economic sustainability uses prosperity as main criterion, meaning that the production of feed ingredients has no negative effects on local and regional economy, but rather contributes to local prosperity, with good distribution of prosperity, income and employment among communities. Social sustainability refers to the welfare of especially employees and local population: working conditions, human rights, property and license rights, social conditions, integrity and competition with food, local energy supply, medicines and building material. Other criteria may include culture and identity, food consumption, food security and human health. Important aspects of ecological sustainability include greenhouse gas emissions, biodiversity, eutrophication, acidification, land use changes, depletion of finite natural resources and energy use. Other criteria can be waste management, use of agro-chemicals, prevention of soil degradation and quality and quantity of groundwater and surface water (Gosselink et al., 2010).

Lack of harmonized methodology

In recent years many standards have been developed for the assessment of impact categories related with sustainability. However, applying such standards often results in different outcomes for the same indicators. Harmonization and preferably standardization of methodology seems to be critical in order to improve the understanding of the sustainability performance of the animal production chain, from feed ingredient production to feed use at a livestock farm. In addition, harmonization is necessary to identify mitigation options based on this improved understanding and to assess their relevance and effectiveness. Moreover, it will increase the credibility of assessment and communication of the sustainability performance of feed products and therefore of animal products. For these reasons, it is important that all stakeholders in the animal feed chain join forces on the harmonization of the methodology.

Global initiatives in the animal feed chain

So far the feed chain stakeholders focused on two types of initiatives. On the one hand the establishment of multi-stakeholders platforms to set principles and criteria for responsible production and on the other hand initiatives aiming for harmonization of methodology. The latter includes initiatives focusing on improving data availability and quality, and quantification of data quality. On a global level, the Round Table on Responsible Soy Association (RTRS) and the Roundtable on Sustainable Palm Oil (RSPO) have been the most prominent multi-stakeholder platforms for feed ingredients. Other standards and certification schemes for feed ingredients were developed by industry or trade associations, often consulting other stakeholders. A successful example is the International Fishmeal and Fish Oil Organization Global Standard for Responsible Supply (IFFO RS). With respect to the harmonization of methodology, several industry initiatives are running, either or not in close cooperation with authorities and NGO's. Most promising is the present development of the Feed Life Cycle Assessment (LCA) Guideline (Blonk et al., 2013 draft). This Guideline results from collaboration between the European Feed Manufacturers' Federation (FEFAC) and the American Feed Industry Association (AFIA) on environmental footprinting and started in 2011. It is in line with the requirements defined in international standards and guidances such as ISO 14044 on LCA and the Product Environmental Footprint Guide from the European Commission (EC, 2013 draft). It is also closely linked to two initiatives aiming at providing methodological guidance regarding the environmental performance of food and feed products:

- The EU Food Sustainable Consumption and Production Round Table which published the draft ENVIFOOD Protocol in November 2012. It specifies requirements for assessing the environmental impacts associated with food and drink products along their life cycle.
- The FeedPrint project from the Netherlands. Initiated in 2009 by the Dutch Product Board Animal Feed (PDV), the FeedPrint initiative developed a set of methodological recommendations as well as a ready-to-use tool to assess the greenhouse gas emissions associated with the production and the use of feed and feed ingredients.

The Feed LCA Guideline is seen as a first step towards a global standard for feed LCA. In that sense it can also be regarded as a contribution from FEFAC and AFIA to the Livestock Environmental Assessment and Performance Partnership (LEAP) hosted by the Food and Agriculture Organization of the United Nations (FAO). Under the umbrella of the International Feed Industry Federation (IFIF), FEFAC and AFIA are members of LEAP since its launch in 2012. The Feed LCA Guideline is also seen as the major component of the future Product Category Rules (PCR). The latter is part of the European Commission strategy on sustainable production. Every sector in the food and feed chain has been invited to make such PCRs. Many sectors are working on this. Although these PCRs should be made in consultation with relevant stakeholders to prevent overlaps and to connect sectors (e.g. the feed industry should consult the rendering industry as supplier), in practice it seems that the one publishing first can set the scene.

Responsible production of rendered products

In contrast to some other feed ingredients mentioned before, neither a round table has been established nor have publically available sustainability standards been developed yet for and by the rendering industry. As a consequence, no relevant impact categories have been selected by stakeholders and no ‘official’ specific calculation rules are available for animal by-products from the rendering industry. However, individual companies have been working on assessments, usually with a focus on greenhouse gas emissions associated with the production of rendered products. This focus can also be explained by the high correlation with energy use. Such assessments are often followed by energy efficiency improvement programs also resulting in a reduction of greenhouse gas emissions.

Environmental footprint of rendered products

The products from the slaughterhouses and meat processing industry can be classified as fresh meat fractions, slaughter by-products and offal. Slaughter by-products can be used for processing into food ingredients (e.g. gelatin), materials (e.g. leather), fuels (e.g. biodiesel) and feed ingredients. In this article the environmental footprint of industrial slaughter by-products generally used as feed ingredients is presented using FeedPrint calculations (FeedPrint, 2013), unless indicated differently. This model focuses on carbon footprint and uses different process flows for fat rendering, fat melting, feather rendering and blood rendering, respectively (Figure 1) (Zeist, van et al., 2012). It is based on publically available data on mass balances and energy use for processing of animal by-products (Table 1) (European Commission, 2005; Ten Kate, 2005). It should be noted that the energy input data is from relatively new facilities. All meat and bone meals are considered as a single animal meal product from "category 3 rendering" at the current stage. Blood powders are considered to be represented in general for blood meal (spray dried), and no differentiation takes place for haemoglobin or plasma powder in the current database. Moreover the upstream emissions of animal husbandry and energy inputs at the slaughterhouse are not allocated to category 3 slaughter by-products (Vellinga et al, 2012). Neither included are greenhouse gas emissions related to capital goods, nor other inputs (e.g. chemicals) and outputs (e.g. wastewater) that are expected to contribute less than one percent to the carbon footprint. Moreover, greenhouse gas emissions related to the production and use of energy carriers for processes that are specific to the by-product (mainly drying) are not allocated to the other by-product(s). Greenhouse gas emissions related to transport and land use and land use change (LULUC) (deforestation and soil organic carbon loss) are reported separately from the embedded emissions. The reason is the fact that for transport typical NW-European data is used and for LULUC the methodology is still subject to debate. For an overview of typical carbon footprints of rendered products and vegetable alternatives, see Table 3.

Comparison of environmental footprints of rendered products with alternatives

It should be clear that rendered products have in general a favorable carbon footprint when compared with alternatives used in animal feed (Table 3). High protein containing products from the fat, feather and blood rendering, with the exception of blood plasma, irrespective of the animal source, all have a relatively low carbon footprint. This difference is even more pronounced when compared on a protein basis or when compared with specialty products derived from the vegetable protein processing (e.g. potato protein). In addition, also fishmeal has a much higher carbon footprint, largely determined by fuel oil use for wild fishery. Some rendering plants can even create lower carbon footprints by using part of their animal fats as energy source. However, it remains questionable whether from the methodology point of view this is an acceptable way of calculation. Animal fats, including poultry fat, have an even more favorable carbon footprint than their alternatives, in particular when compared with palm oil.

Rendered products for sustainable animal production

In addition to responsible production of rendered products, feed ingredients from the rendering industry can also contribute to sustainable animal production. Actually, rendered products have traditionally been used by the animal feed industry for their high quality nutrients. Only few feed ingredients can compete with the high density of energy and other valuable and highly digestible nutrients, such as essential amino acids, phosphorous and micronutrients. This makes rendered products very suitable for specialty feeds, including young animal feed (e.g. piglet feed) and high density formulations (e.g. broiler feeds). Moreover, it can partly and sometimes even completely replace fishmeal and fish oil in fish feed. The latter is important as this is considered one of the major sustainability challenges in aquaculture. The availability of marine products is limited and this may severely inhibit the growth of the young and successful aquaculture business. These examples also illustrate that the rendering industry should not only focus on the responsible production of animal by-products, but also on the application of the products in sustainable animal production systems. From the sustainability point of view such positive effects downstream the value chain may outweigh the potential negative effects of animal by-product production. It also invites the industry to develop new innovative products of interest for sustainable animal production. Animal tissues do contain many bioactive substances which can have interesting effects on animal health and performance. Last but not least it shouldn’t be forgotten that rendering prevents a tremendous amount of waste from slaughterhouses and can indirectly protect valuable ecosystems from deforestation and soil depletion by reducing the need of vegetable alternatives.

Conclusions

The process of making sustainability operational is dynamic and different approaches can be used by the rendering industry. Multi-stakeholder platforms, such as round tables may have an important role to play in the determination of principles and criteria and to initiate the process of improving and proving sustainability. However, in contrast to the present well known round tables for soy and palm, the scope should be broader than just the responsible production of rendered products. Upstream (i.e. preventing waste from slaughterhouses) and downstream (i.e. rendered products as feed ingredients for sustainable animal production) effects may even be more relevant due to the ‘positive’ contribution in a broader animal value chain perspective. The latter implies that it may be better instead of establishing a round table on responsible rendered products, to connect and join forces with one of the leading initiatives on sustainable animal production. Nevertheless it remains important that the rendering industry internally harmonizes the methodology of the major impact categories of relevance for sustainability using and applying international standards. Generating of high quality data and making such data available is crucial in the process of harmonization and connection with other initiatives. Only when complying with these ‘prerequisites’, credible and trustworthy communication can be started by the rendering industry both towards value chain partners, consumers and society. Together with the high sustainability potential of rendered products, it will also open the door for value creation in markets where sustainability has become a priority.

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Figure 1: Flow charts of rendered products for LCA analyses.

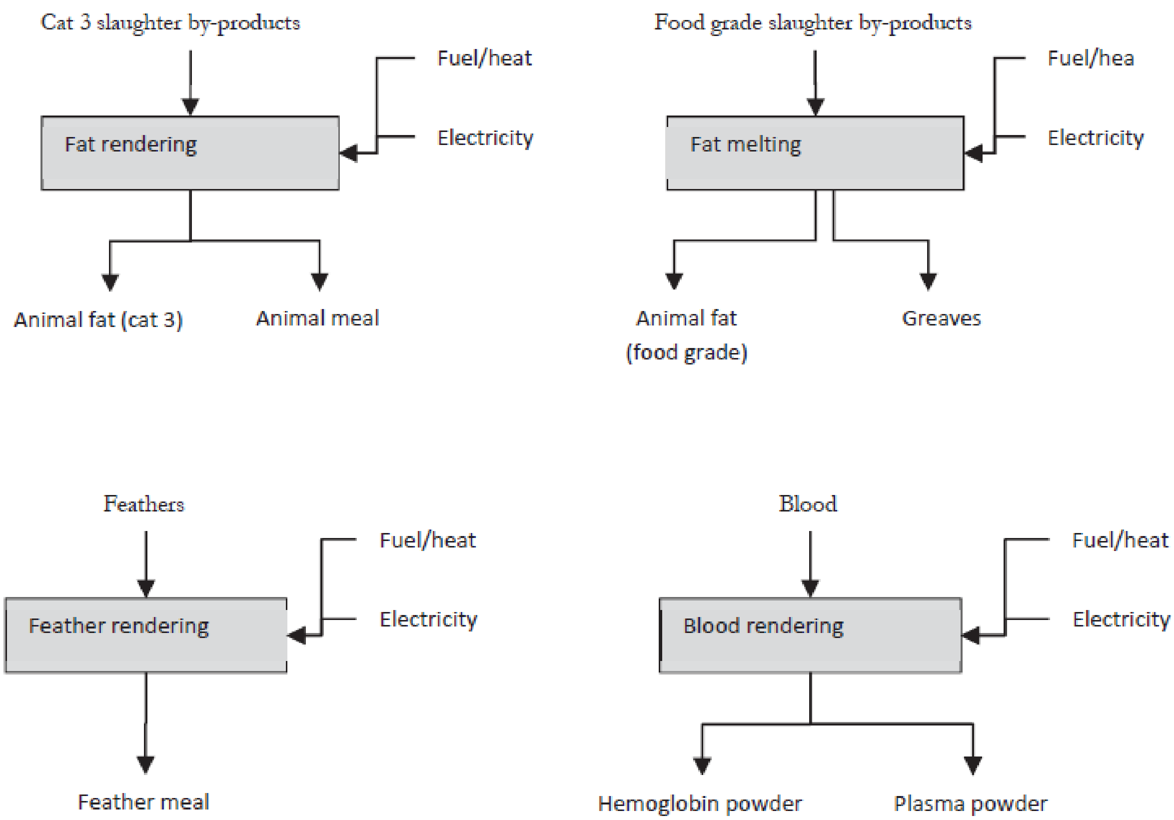

Table 1: FeedPrint inputs. Mass balances after rendering 1000 kg of various slaughter by-products (European Commission; Ten Kate, 2005) and data for allocation purposes (van Zeist, 2012).

Raw material / Feed ingredient	Quantity (kg)	Proteins (%)	Mineral (%)	Fat (%)	Water (%)	DM (g/kg)	Price (euro/kg)	GE (MJ/kg)
Cat.3 slaughter by-product	1000	9	2	14	74			
Animal meal	150	60	13	12	5	950	0.21	14.6
Animal fat	120	0	0	99	1	990	0.54	36.6
Food grade slaughter by-products	1000							
Greaves	230	60	13	12	5	950	0.21	14.6
Food grade fat	150	0	0	99	1	990	0.87	36.6
Blood	1000	12	1	0	87			
Haemoglobin powder	140	88	5	2	5	950	1	15.7
Plasma powder	40	88	5	2	5	950	4	15.7
Feathers	1000	28	1	2	69			
Feather meal	330	85	2	7	6	940	-	17.0

Table 2: FeedPrint inputs. Default energy inputs per 1000 kg slaughter by-products (van Zeist, 2012).

Process	Parameter	Min	Max	Unit
Dry rendering				
	Heat	1400	1600	MJ/tonne
	Electricity	126	180	MJ/tonne
Fat melting				
	Heat	1433	2000	MJ/tonne
	Electricity	241	371	MJ/tonne
Feather meal				
	Heat	800	1000	MJ/tonne
	Electricity			
Blood products				
	Heat	1600	1750	MJ/tonne
	Electricity	360	432	MJ/tonne

Table 3: Carbon footprints (CFP) of selected feed ingredients (FeedPrint, 2013, unless indicated differently)

Feed ingredients	CFP embedded (g $CO_{2\text{-eq}}$/kg)	CFP transport (1) (g $CO_{2\text{-eq}}$/kg)	CFP Total (g $CO_{2\text{-eq}}$/kg)	CFP LULUC (1) (g $CO_{2\text{-eq}}$/kg)
Fat rendering				
Animal meal	227	33	260	-
Animal meal (porcine/poultry) (3)			190	
Poultry meal (3)			590	
Bone meal (porcine/poultry/bovine)	227	33	260	
Animal fat	584	68	652	
Poultry fat (4)			750	
Animal fat (porcine/poultry/bovine) (4)			400	
Fat melting				
Greaves meal (porcine/poultry/bovine)	160	22	182	
Animal fat (food grade) (4)			850	
Blood rendering				
Blood meal (spray dried)	811	68	879	-
Blood plasma (porcine) (5)			3200	-
Blood plasma (bovine) (5)			2640	-
Haemoglobin powder (porcine) (5)			870	
Haemoglobin powder (bovine) (5)			790	
Feather rendering				
Feather meal (hydrolysed)	153	42	194	-
Marine by-products				
Fish meal	1047	328	1374 (1100-2300) (2)	-
Vegetable feed ingredients				
Rapeseed meal	526	46	572	178
Soybean meal	395	180	575	394
Potato protein	987	107	1094	223
Palm oil	3715	302	4017	284
Fats/oils vegetable (mixture)	-	-	1591	-

(1) Separate reporting of emission due to transport and land use and land use change (LULUC). The reason is the fact that for transport typical NW-European data is used and for LULUC the methodology is still subject to debate.

(2): (…) range of data mentioned in literature.

(3): Source: Ponsioen & Blonk, 2010. This carbon footprint of poultry meal includes fifty percent of the upstream emissions (based on economic allocation) and some animal fat as energy source.

(4): Source: Ponsioen & Blonk, 2010. This carbon footprint of poultry and mixed fat includes fifty percent of the upstream emissions (based on economic allocation) and some animal fat as energy source.

(5) Source: Ponsioen & Blonk, 2011. The carbon footprint of haemoglobin and plasma powder includes animal husbandry (including the feed supply chain, transport, and manure management), the slaughtering process for the supply of blood, transport of blood (diesel use), general processes (separation and wastewater treatment), and haemoglobin and plasma powder production (mainly drying).