Food and Agriculture Organization of the United Nations

ENVIRONMENTAL PERFORMANCE OF ANIMAL FEEDS SUPPLY CHAINS

SUMMARY OF THE GUIDELINES FOR ASSESSMENT

OVERVIEW

The feed industry is an internationalised and dynamic part of the agricultural sector. The last few years have been witness to rapid dietary changes worldwide, with an increase in demand for animal sourced food, including meat, dairy products and eggs. One consequence of this demand-led transition in the human diet has been an increase in the demand for animal feed. At the same time, the feed sector faces a variety of challenges, arising from an ever-changing environment, increasing demand and competition for resources, as well as high and volatile commodity prices. Feed is usually the major cost or significant resource associated with livestock production.

The animal feed sector depends on various sources for feed material, including crop production, the food industry, products derived from the slaughter and processing of livestock, the marine industry and biofuels. Consequently, feed supply chains vary widely depending on the particular raw material and its intended uses. Broadly, a distinction can be made between ruminant species that feed mainly on roughages, such as grass, leaves and forage feedstuffs; and monogastric species that depend in large part on feed materials from crop production, such as grains, oil crops and household waste. Globally, livestock consumed 6.3 billion tonnes of feed (dry matter) in 2005, with ruminants consuming the bulk of feed (4.9 billion tonnes compared with 1.4 billion tonnes for pigs and poultry). Overall, grass and roughages comprise about 44% of the feed used by livestock, followed by crop residues (28%). Grains, by-products from processing and other edible crops each comprised 9% of the feed used by the livestock sector, while swill and second-grade crops comprised 2% and 1%, respectively.

Different feedstuffs are used for the production of different livestock commodities. Most feed grain (69%) is fed to pigs and poultry; the rest is used in ruminant production, particularly for cattle. This is in part determined by the animal's physiological features. Ruminants, in particular, have evolved with micro-organisms in the rumen capable of digesting fibrous feedstuffs. However, the inclusion of grain in ruminant diets, as a highly concentrated source of energy, can greatly enhance the efficiency of animal production.

CHALLENGES AND SOLUTIONS

The GHG emissions from livestock supply chain are estimated at 7.1 gigatonnes (Gt) CO_2e per year, representing 14.5% of all anthropogenic GHG emissions. Globally, GHG emissions from the production, processing and transport of feed account for about 45% of sector emissions. Fossil carbon dioxide (CO_2) and nitrous oxide (N_2O) are the dominant GHGs emitted in animal feed production. The fertilization of feed crops and the deposition of manure on pastures generate substantial amounts of nitrous oxide emissions, together representing about half of the emissions from feed (one-quarter of the sector's overall emissions). CO_2 emissions result largely from the use of fossil fuels, particularly diesel in tractors and harvesting machinery, oil in dryers and natural gas in the manufacture of mineral nitrogen fertilizer. In the post-farm stages, CO_2 is emitted in conjunction with various feed processes and is associated with processing, mixing, and distribution of feed ingredients.

About one-quarter of the emissions related to the feed supply chain (about 9% of the livestock sector's emissions) are associated with land-use change. Land-use change may be followed by distinct or drastic changes in land quality, such as decreases in biodiversity, increased soil compaction, loss of nutrients, impacts on water availability and quality. These quality losses constitute the ecological damage from land-use change. However, land use for animal feed production can also have a positive influence on the carbon balance, as the soil acts as a carbon sink instead of as a source of emissions (e.g. deforestation). Permanent, well-managed grassland is a form of land use that has the highest potential to function as a carbon sink. In addition to the impacts from GHG emissions, the way land management practices can have wider environmental impacts on soil, water, microclimate, and biodiversity.

Demand for livestock products is projected to grow 1.3 percent per annum until 2050, driven by global population growth and increasing wealth and urbanization. Against the background of climate change and increasing competition for natural resources, this projected growth places significant pressure on the livestock sector to perform in a more sustainable way. The identification and promotion of the contributions that the sector can make towards more efficient use of resources and better environmental outcomes is also important.

Currently, many different methods are used to assess the environmental impacts and performance of livestock products. This causes confusion and makes it difficult to compare results and set priorities for continuing improvement. Conscious of these challenges, LEAP Partnership established in 2013 a technical advisory group to develop comprehensive guidelines on the assessment of the environmental performance of animal feeds supply chains. Through consensus building, TAG experts from all regions of the world developed the guidelines, which strive for alignment with international standards such as ISO 14040/44 and IPCC guidelines. These guidelines are relevant for all animal feeds production systems and provide methods to assess greenhouse gas emissions, land occupation, and are illustrated with case studies. These guidelines are transparent and comprehensive because different review processes were undertaken, from peer-review to public review. They provide transparent allocation rules between co-products and they address data collection and data quality assessment, inventory and interpretation and reporting of results supported by uncertainty and sensitivity analysis.


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SUMMARY OF FEED GUIDELINES

The guidelines provide an overview of life cycle assessment and life cycle thinking applied to animal feed supply chains. Broadly the supply chains can be viewed to have four main stages:

- **Feed production stage.** Most feed products are of plant origin with their production starting with crop cultivation. Feed crop cultivation takes place in a wide range of cropping systems with varying practices including intercropping, perennial cropping systems, grazing systems and silvopastoral systems. Important non-plant sources of raw materials for feed include animal co-products, such as dairy products, animal fats and oils, blood, and fishmeal and oil.
- **Processing stage.** Processing of feed can range from the simple on-farm processing of crop residues using chaffer cutters or feed pulverizers with low energy inputs, to more complex, specialized industrial processes producing more than one co-product, such as the wet milling process for maize.
- **Feed mill stage.** This stage includes both feed compounding and the blending of various feedstuffs and additives.
- **Farm.** The on-farm feed stage includes all activities associated with preparing the feed for the animal. In some situations, there is no further processing, while in other circumstances farmers prepare rations by blending feedstuffs into a single, complete ration.
- **Transport and storage.** This can be considered an intermediate step is linking the four main stages and will differ depending on the feed chain type. Transport utilization across the feed supply change can range from nil (e.g. in grazing feeding systems) to the use of animal draught power (e.g. in mixed livestock-cropping systems) or reliance on internationally traded feed materials.

The guidelines provide specific recommendations for data requirements and data quality at each stage of the animal feed production supply chain, with an understanding that a modular approach provides significant versatility in the execution of assessment studies.

One of the most important components of the guide is the approach recommended for handling multi-functionality in the supply chain, for example, the use of soymeal as an animal feed protein source is associated with a coproduct of soy oil, and guidelines provide specific recommendations for calculation of allocation factors.

The guidelines represent an open and transparent approach for assessing environmental sustainability characteristics of animal feeds, and the guideline is anticipated to be used closely in conjunction with guidelines specific to individual livestock species.

LIVESTOCK ENVIRONMENTAL ASSESSMENT AND PERFORMANCE (LEAP) PARTNERSHIP

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