OVERALL APPROACH

RUMINANT LIVESTOCK FARMING AND CIRCULAR ECONOMY

UNDERSTANDING & EXPLAINING THE SERVICES PROVIDED BY LIVESTOCK FARMING

« How does ruminant farming contribute to the circular economy and bioeconomy? »

1. Livestock manure is used to fertilise soil, limiting the use of synthetic fertilisers. It can also be recycled through local methanisation, thereby producing energy while limiting the transport of inputs.
   Beyond its value for energy production, methanisation produces digestate, which is used as a natural fertiliser by farmers.

2. Farmers are actively involved in the circular economy by recycling non-organic agricultural waste.

3. Ruminant farming prevents by-products from crops intended for human consumption from becoming waste by using them in animal feed.

4. Ruminant farming provides leather, wool and industrial by-products which, without livestock farming, would have to be replaced by synthetic materials or other types of materials that may be imported.

5. The quest for protein self-sufficiency in animal feed at the regional level makes it possible to apply the principles of the circular economy by reducing external purchases.

6. Farms integrated into local food systems contribute to a circular economy, notably by reducing flows and packaging, while promoting responsible consumption.

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RUMINANT LIVESTOCK FARMING AND CIRCULAR ECONOMY

WHAT ARE WE TALKING ABOUT?

According to the European Commission, **the circular economy** is an economy in which the value of products, materials and resources is maintained in the economy for as long as possible and waste production is minimised. According to the Environmental Code, "the transition to a circular economy aims to move beyond the linear economic model of extracting, manufacturing, consuming and discarding, by calling for the sober and responsible consumption of natural resources and primary raw materials, as well as, in order of priority, the prevention of waste production, in particular through the reuse of products and, in accordance with the hierarchy of waste treatment methods, the reuse, recycling or, failing that, recovery of waste" (Environmental Code, Article L. 110-1-1).

The agricultural sector is a key player in the circular economy. Main challenges are the origin of the fertilising resources needed for production, the driving role of farmers in the development of the circular economy, and the limitation and management of agricultural waste (Ministry of Agriculture and Food, 2019b). In the field of agriculture, it is also necessary to define **the bioeconomy**, which "encompasses all activities involved in the production and processing of biomass, whether forestry, agricultural or aquaculture, for the purposes of food production, animal feed, bio-based materials and energy. It represents opportunities for our agricultural and forestry operations and enables us to increase the competitiveness of our industries, while providing sustainable solutions to the environmental and societal challenges we face today. The bioeconomy is part of the broader green economy, i.e. an economy that respects the environment and uses natural resources more efficiently" (Ministry of Agriculture and Food, 2019a).

The combination of the principles of the circular economy and the bioeconomy is called the **circular bioeconomy**. It emphasises the use of a circular approach to the bioeconomy (Kardung *et al.*, 2021; Madelrieux *et al.*, 2023). Ruminant farming, through its consumption, processing and supply of biomass, but also through its diversity, is a major asset for the circular bioeconomy (Dourmad *et al.*, 2019).

1 Recycling livestock effluent

Ruminants utilise nitrogen from grasslands and limit the use of chemical fertilisers

Herbivores are the only animals that can make use of grasslands and the nitrogen they contain. They convert this nitrogen into milk and meat. Some of the nitrogen ends up in the manure they produce and is used to fertilise the soil for crops intended for animal feed, but also for human consumption. As a result, ruminant farming is essential for maintaining soil fertility and limiting the use of synthetic fertilisers (Van Hal *et al.,* 2019). Livestock manure decomposes through mineralisation: nutrients such as nitrogen, phosphorus, sulphur and potassium are released into the soil, feeding the plants (Rieutort *et al.*, 2014). Exchanges of straw and manure between livestock farms and cereal farms can also contribute to this recycling process. However, it is important to take the fertilising value of manure into account in order to avoid losses to the environment. Generally speaking, at the regional level, integrating plant and animal production through the exchange of materials within mixed farming systems is an effective way of closing nutrient cycles (Madelrieux *et al.*, 2023).

At a time when the 'feed-food' competition is calling into question the place of livestock farming in the use of agricultural land, it is important to remember its role as a pillar of food production and the circular economy.

At the local level, recycling livestock manure through methanisation makes it possible to produce energy and provide digestate to fertilise soil, while limiting carbon-intensive transport of inputs

Livestock farms produce manure that can be converted into biogas using biogaz plants.
This reduces the farm's overall carbon footprint, contributes to soil fertilisation through the spreading of methanisation digestate, and reduces the farm's energy consumption. On a local scale, methanisation units help to limit carbon-intensive transport of inputs. Nevertheless, there are recommendations for the sustainable development of methanisation:

- Prioritise farm fertilisers, waste and crop residues in the biogas plant to limit competition with animal and human food;
- Consider the role of grazing in your livestock farming system independently of methanisation and simply use the animal manure available in your biogaz plant;
- Prioritise either small-scale installations on individual farms or collective agricultural installations supplied by animal waste (Dumont *et al.*, 2019).

However, farmers remain in the best position to make the choices that are most suited to their systems and their territories.

KEY FIGURES

7,8 Mt of CO_2eq will be avoided in 2021 thanks to locally spread livestock manure (compared to average synthetic fertilisers). This represents the annual carbon footprint of more than **700,000** French people (GIS Avenir Elevages, 2023).

LEARN MORE... ...about the impact of ruminant farming on soils,

CHECK OUT THE SHEET ➡
« Ruminant farming and soils quality ».

LEARN MORE... ...about methanisation,

CHECK OUT THE SHEET ➡
« Ruminant farming and energy ».

RUMINANT LIVESTOCK FARMING AND CIRCULAR ECONOMY

2 Recycling non-organic agricultural waste

The agricultural sector is moving towards more sustainable and circular resource management

Farmers are key players in the circular economy through their commitment to recycling agricultural waste. Specific disposal channels for agricultural waste are being set up. In the medium term, all waste produced on farms will have a clearly identified disposal channel. ADIVALOR (Agriculteurs, Distributeurs, Industriels pour la VALORisation des déchets agricoles) is a key player in this process. It defines the technical procedures for managing various agricultural inputs at the end of their life cycle, from sorting at the farm to final treatment. As a result, the number of farmers involved in recycling is constantly increasing, reaching a total of 300,000.

These farmers participate in waste collection programmes, for which they must prepare and store end-of-life products, then deliver them on the dates and to the locations specified by their distributors. Among the recycled waste are:

- Twine, recycled into irrigation connectors and eco-designed twine;
- Big bags, recycled into plastic crates and construction elements;
- Plastic films are recycled into rubbish bags;
- Plastic containers, recycled into tubes and technical ducts;
- Paper bags with protective layers (www.adivalor.fr).

Similarly, systems for collecting used tyres are being put in place.

Thanks to initiatives such as those of ADIVALOR and the commitment of farmers, the agricultural sector is moving towards more sustainable and circular resource management.

KEY FIGURES

In France, **300,000** farmer-recyclers (www.adivalor.fr).

41% of the twine and netting used in round bales for ruminant farming is collected and recycled (www.adivalor.fr).

90% of packaging and plastics collected in the agricultural sector were recycled (www.adivalor.fr).

3 The valorisation of by-products from the agri-food industry

Ruminant farming prevents by-products from crops intended for human consumption from becoming waste by using them in animal feed

Crops intended for human consumption contain parts that are not edible or not consumed by humans. Farm animals have the ability to utilise these elements. This recycling takes place as soon as the crop is harvested and continues throughout the preparation of human food. For example, in the production of wheat for human consumption, livestock utilise straw from the field stage, as well as all co-products from milling, starch production, malting, etc. (e.g. bran, middlings, draff) (GIS Avenir Elevages, 2022). Thus, by-products that are not consumable by humans and are introduced into ruminant rations improve the net protein and energy efficiency of production systems. In fact, this utilisation by ruminants helps to limit competition with human food (Laisse *et al.*, 2018).

If livestock farming were to disappear, crop by-products would become waste and would no longer be utilised locally in animal feed. This would result in a loss of added value for the region and an increase in pollution due to transport (Rieutort *et al.*, 2014).

KEY FIGURES

In France, the value of by-products in animal nutrition has increased by **43%** in **10 years** (Réséda, 2017).

By-products account for nearly **50%** of the raw materials used by livestock feed manufacturers. **2/3** are oilseed meal from oilseed crops and **1/4** are from cereals. (Réséda, 2017).

4 The production of animal by-products

Ruminant farming also provides leather, wool and industrial by-products

In addition to converting food that is inedible to humans into food with high nutritional value, ruminants also produce a multitude of other by-products. This fifth quarter consists of several categories of products: offal and tripe products, food by-products (blood, bones, fat) that cannot be consumed directly but can be processed, hides and animal by-products that are not directly intended for human consumption but are used for industrial purposes. They supply our society with biological raw materials that are useful in many sectors of activity:

- Leather and hides for the leather and hide industry and craftsmanship;
- Wool for clothing, bedding, furnishings and decoration, eco-construction and other uses (fertiliser, mulch, biomaterials, medical, cosmetics, etc.);
- Animal fat for pharmaceutical use;
- Slurry and manure for composting and spreading for fertilisation;
- Processed animal fats and proteins for biofuel, fuel, fertiliser production, composting, methanisation, pet food, aquaculture, oleochemistry, soap manufacturing;
- Meat (muscle and offal), gelatinous bones and rind for gelatin (Rieutort *et al.,* 2014; according to Celene, Sifca, Atemax, 2013).

The advantage of promoting animal by-products rather than other products manufactured for the same purposes

Without livestock farming, the textile, construction, energy, medicine, pharmaceutical and all other sectors that use animal by-products would loose a significant amount of renewable raw materials. To meet the needs of the population, these would necessarily have to be replaced by other materials, particularly those derived from fossil fuels, which require extensive industrial processing and provide little or no benefit to the environment (GIS Avenir Elevage, 2023).

KEY FIGURES

10,000 tonnes of wool produced per year in France (according to the Collectif Tricolor).

3,160,000 attle hides produced in France in 2022, **1,100,000** calf hides, **4,055,000** sheep hides, **649,000** goat hides (FAOSTAT).

LEARN MORE... ...about the by-products valorisation,

CHECK OUT THE SHEET ➡ « Ruminant farming and by-products ».

5 Territorialised food systems

Territorialised food systems: towards a circular economy

The integration of farms into local food systems, which are strongly committed to food relocation projects, local distribution channels, and local farmers and consumer is also based on the principle of the circular economy. This helps to limit flows, reduce packaging use (less packaging and transport) and enables more responsible consumption (local consumption, better control of product marketing for producers; less dependence on volatile global costs).

6 The quest for protein self-sufficiency

Protein autonomy: applying the principle of the circular economy by reducing external purchases

The quest for protein self-sufficiency, by avoiding the purchase of imported soybean meal, particularly from America, and favouring local or regional resources, is a good illustration of the principles of the circular economy. The aim of the ruminant sectors is to strengthen farm autonomy and local supply by limiting imports and increasing sustainable production capacity and the use of protein-rich fodder (legumes, protein crops, multi-species grasslands, etc.).

The aim is also to promote the use of oilseed meal and oilseed grains produced in France and Europe in livestock farming. Furthermore, depending on protein yields and digestibility, and if the climate and soil allow it, the production of protein-rich concentrates (peas, lupins, field beans, whether whole, flattened or crushed) enables livestock farming systems to be more self-sufficient.

But above all, improving protein self-sufficiency requires optimising the balance of the feed ration. The more protein-rich the basic ration is, for example through the use of grazed grass and legume-rich meadows, the less relevant the additional protein intake is. The 2030 Protein Plan aims to ensure national protein sovereignty by 2030. It includes a significant research, development, innovation and transfer component: the Cap Protéines programme (www.cap-proteines-elevage.fr).

KEY FIGURES

Protein self-sufficiency according to farming systems:
86% for beef cattle
83% for sheep
70% for dairy cattle
68% for dairy sheep
47% for goats
(Cap Protéines).

LEARN MORE... ...about protein self-sufficiency,

CHECK OUT THE SHEET ➡
« Ruminant farming and animal feed ».

ACTIONS AND TOOLS IMPLEMENTED BY THE SECTORS

The roadmap for the circular economy

Published on 23 April 2018, the roadmap for the circular economy (FREC) relies on the mobilisation of everyone, including citizens, local authorities, businesses across all sectors, associations, administrations, and research and development stakeholders.

This roadmap includes 50 measures for a 100% circular economy based on four themes: how can we produce better? How can we consume better? How can we manage our waste better? How can we mobilise all stakeholders?

As the agricultural sector is a key player in the circular economy, an agricultural section of the FREC was published in 2019 (Ministry of Agriculture and Food, 2019b). It is mainly recognised for: the recovery of bio-waste on agricultural land and the reduction of non-renewable fertiliser consumption; the reduction of losses and waste in primary production; and the improvement of waste prevention and management on farms.

ADIVALOR

ADIVALOR (Agriculteurs, Distributeurs, Industriels pour la VALORisation des déchets agricoles) (www.adivalor.fr) defines the technical procedures for managing various agricultural inputs at the end of their life cycle, from sorting at the farm to final treatment.

The organisation is also involved in the preparatory and organisational phases. It provides operators with communication tools focused on prevention, education and information in the field of waste.

In parallel with these operational activities, the organisation is developing a research and development centre responsible for developing collection procedures for each type of waste, refining the assessment of agricultural waste sources, optimising the costs and processes of the various sectors, and proposing eco-design criteria to manufacturers when developing packaging or formulations.

The project brings together 300,000 farmers, 1,300 collection operators, 350 marketers and 20 agricultural waste streams.

The "Les Coproduits" network

Led by the French Association of Animal Science (AFZ) and Duralim, the network aims to bring together stakeholders who wish to collectively reflect on the production and use of by-products to ensure sustainability. The Les Coproduits network is aimed at all stakeholders in the bioresource recovery sector within the agricultural, agri-food, industrial and energy industries. The objectives are to:

- Provide information to improve understanding of by-products;
- Collectively reflect on the challenges of by-products in order to optimise their value in the various sectors;
- Supporting efforts towards a sustainable circular economy.

The national roadmap for structuring the French wool industry

Its objective is to identify short- and long-term courses of action to structure the French wool processing and marketing sectors in France, thereby reducing the proportion of wool that is not marketed or exported without added value for our regions.

It can be viewed online at: https://www.collectiftricolor.org/feuille-de-route-nationale.

VICTOR

Based on detailed assessments of the current situation regarding short supply chains for beef and pork meat and meat products, the VICTOR (Viandes en circuits courts) project (https://idele.fr/victor/) aims to:

- Identify and prioritise quality criteria for short supply chain stakeholders (producers and customers, in relation to local areas);
- Diagnose farmers' needs in terms of tools to achieve these objectives within the constraints of organisation and profitability of short supply chains;
- Develop these tools to effectively support them in diversifying their activities. These tools, intended for farmers, their advisors and trainers (continuing education and/or studies) in the context of short supply chains, will be in digital format in order to complement face-to-face training and to best adapt to the availability and constraints of the target audiences.

ACTIONS AND TOOLS IMPLEMENTED BY THE SECTORS

RED SPyCE

The RED SPyCE project (2016-2019) (https://idele.fr/detail-dossier/livrables-du-casdar-red-spyce) aimed to contribute to improving the performance of mixed farming operations by producing new references and simple, quick-to-use tools to secure their operation and, by meeting the expectations of livestock breeders, to enable them to lead a more comfortable life in these systems, where on-call work is often poorly regarded. The project was carried out at the farm level and involved six regions in France. The aim was to make crop/livestock integration (C/L) a strength, a concrete and objective asset for improving the performance of mixed farms. The use of databases from the Institut de l'Elevage, INRAE in Theix and the Réseau Agriculture Durable, in addition to more than 60 surveys of farmers in contrasting situations, has made it possible to produce new references. Combined with forward-looking work in four French regions, recommendations for public policy have been produced.

Cap Protéines Project

In order to develop protein self-sufficiency in ruminant farming, the Cap Protéines project has two objectives:

- Increase protein production in livestock farming through legume-based pastures; pure legumes and cereal-protein crop mixtures;
- Promote the use of oilseed meal and oilseed grains produced in France and Europe in livestock farming instead of imported soybean meal.

The Cap Protéines programme was developed over two years of research, development, innovation and transfer. It brought together more than 200 technical partners, 100,000 oilseed and protein crop producers, more than 100,000 ruminant farmers, 330 pilot farms, 21 experimental sites and 19 agricultural college farms. It has led to a 40% increase in the area under legumes and the maintenance of 2 million hectares of oilseed and protein crops.

Tools have been developed to promote independence: :

- Devautop, a protein autonomy diagnostic tool;
- AutoSysEI, resource platform on independence;
- HappyGrass, smartphone app for grassland management;
- Optim'AL, tool for autonomy on nitrogen concentrates;
- Perpet, serious game for assessing and ageing grasslands;
- My Luzerne, decision-making tool for alfalfa cultivation.

The Protein Plan 2030 aims to ensure France's protein sovereignty by 2030 (www.cap-proteines-elevage.fr).

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