



NUTRI • KNOW

# Livestock Farming

Technologies, tools and recommended practices from  
NUTRI-KNOW's EIP-AGRI Operational Groups



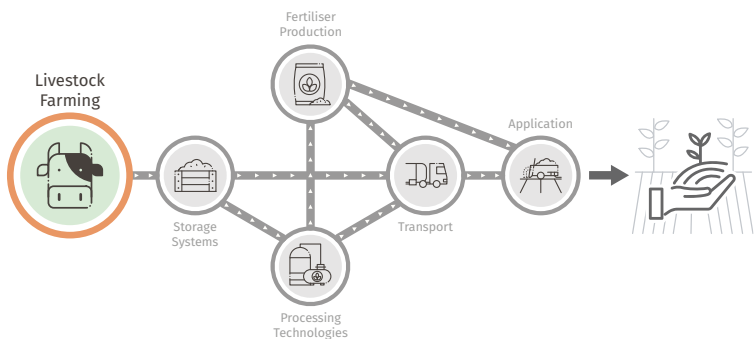


# Introduction

Never before have the media, the general public, and policymakers discussed the future of livestock farming and its environmental and social sustainability as much as they do now. The European livestock sector, aware of its role, is seeking knowledge and innovation from research to face future challenges.

The main outcomes from the EIP-AGRI Operational Groups involved in the NUTRI-KNOW project support a shift towards more sustainable systems. These systems focus on issues concerning the environment, health, and animal welfare. Key strategies to reduce the environmental impact of livestock farming include improving production efficiency, reducing the use of external inputs like nutrients and energy, and replacing industrial fertilisers with recycled ones.

Moreover, livestock farming is crucial for managing nutrients throughout the value chain. This includes improving the efficiency of nitrogen and phosphorus use in animal feed, finding new feed sources, and reducing nutrient losses from livestock housing.



# Livestock Farming

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This booklet offers an overview of the decision support tools, technologies, and recommended practices that are the outcomes of key EIP-AGRI Operational Groups involved in the NUTRI-KNOW project and related to the livestock farming step of the nutrient value chain.

By applying the results from these regional groups across Europe, the livestock sector can adopt good practices to reduce ammonia and greenhouse gas emissions during the breeding phase, improve breeding conditions, recover nutrients and reduce losses to the environment (such as nitrogen emissions and nitrogen and phosphorus leaching), and utilise new feed sources to lower the carbon footprint of livestock farming. For more information see the links to the home pages of the Operational Groups presented below.



# Bio-Based Products and Organic Farming

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The creation of bio-based products can help to encourage more closed-loop supply chains through the recycling of organic manures and other waste materials. They can also stimulate innovative practice uptake and new business opportunities in the organic sector. Sustainable biogas production, for instance, has the potential to reduce methane emissions from the storage of manure, generate renewable energy, and support crop yields through digestate application. Processing technologies and materials used to produce bio-based products must be in line with organic principles and standards. Bio-based products, for example, derived from animal waste obtained from permanently housed operations are not permitted in organic farming owing to potential contamination risk. Furthermore, some innovations reported in this booklet may not be applicable or economically sustainable in extensive or organic farming systems.





## A Tool to **Assess** and **Support** Farmers in **BATs** Application

The main objective of the Operational Group FERTICOOP was to develop innovative tools to help the farmers to understand, evaluate and apply the best technologies available (BAT) to reduce environmental impacts of livestock farm, manure management and agricultural fertilisation. The focus was on reducing phosphorus, improving the agricultural management of slurry, to enhance the valorisation and the quality of the extensive crops produced.



Pig livestock cooperative involved in FERTICOOP

One of the goals of the FERTICOOP tool is the assessment of the emissions in pig and poultry farms and then promote strategies to minimise ammonia and GHG emissions through the application of good techniques at livestock farm level.

### Benefits

- Evaluation of different BATs depending on the characteristics of the different fields and training farmers on them.
- Provide knowledge and advice to farmers on the best available techniques to reduce ammonia and GHG emissions from livestock farm.
- Reduction of GHG and ammonia emissions by optimizing fertilisation and adopting measures in the management of livestock droppings on the farm.
- Utilise livestock manure effectively by understanding its precise fertiliser content.
- Adapt the technological and digital tools available to the needs of the technical advisors in fertilisation and environment technicians of the cooperatives.
- Advice and give support to the cooperative's technicians.



Pig livestock cooperative involved in FERTICOOP



### Current Status

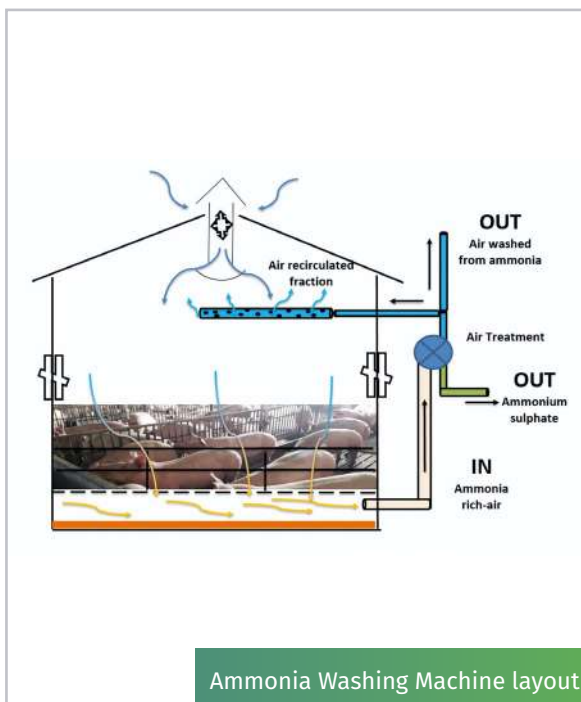
The Operational Group finished and innovation is near to practice. The analysed tools and methodologies are implemented on the cooperatives' farms of the Operational Group and continued to be applied and developed.



More information can be accessed at the home page of the Operational Group **FERTICOOP-GO**

## An Air Washing System That Removes Ammonia From Pig Stables

GAS LOOP has developed and tested for one year (in a pig house for Parma ham PDO heavy pigs) an air washing system designed to tackle the issue of ammonia emissions in pig farming. By drawing air from beneath the slatted floor of pig stables and treating it with sulfuric acid, the ammonia emissions are captured and prevented from spreading into the room. The treatment is based on the chemical absorption of ammonia by counter-current washing with an acid reagent sprayed into a tower scrubbing. As a result, the recovered ammonia is transformed into ammonium sulphate fertiliser.



Ammonia Washing Machine layout



## An Air Washing System That Removes Ammonia From Pig Stables



Sant'Anna pig farm, partners of the Gas Loop operational and experimental site

### Benefits

- Treatment reduces ammonia emissions from pig livestock for 1.94 kg NH<sub>3</sub> per animal place per year.
- Results in improvements in the indoor air quality, reducing the ammonia concentration inside the treated room by 62% compared to the control room.
- Positive effects of the treatment on the productivity of pigs by increased animal welfare.
- Better health of the pig's lung at the slaughterhouse
- Ammonium sulphate solution recovered by capturing ammonia, reduces nitrogen inputs for the farming crops and consequently the GHG emissions generated by their industrial production: 66 kg CO<sub>2</sub> equivalents saved per year per t of pig live weight housed.
- More sustainable pig livestock, less odour emissions.



### Current Status

Gas Loop has implemented the system up to a technological maturity level equal to Technology readiness level (TRL) 8. The device is installed by all the pig livestock partners in the Operational Group.



More information can be accessed at the home page of the Operational Group **GAS LOOP**

## New Feed Source for Cattle and Pigs From Grass

Biorefinery Glas focused on the demonstration of a small-scale grass biorefinery with farmers in Southwest Ireland to diversify farmer produce while resolving significant challenges in traditional agriculture. The biorefinery converts freshly harvested grass from low-quality or surplus sources into novel and innovative animal feed streams. A solid fraction press-cake fibre feed for cattle produced from grass and a liquid green fraction protein concentrate can serve as pig feed.



Grass biorefinery, South West Ireland

Fresh grass is loaded into the biorefinery, crushed and pressed to separate up to 50% of the protein into a liquid juice fraction. The remaining 50% is pressed into a high solid fibre press cake that can be fed directly to cows. The solid grass press-cake can be baled into silage for cattle to increase the shelf life of the feed. The liquid protein concentrate can be dried and used as an import replacement feed for monogastrics.



Grass biorefinery feed products

### Benefits

- Press cake silage can partially replace grass silage in dairy cows' diet. Milk yield and milk quality were not affected by replacing grass silage with press cake silage.
- Reduction in invitro methane production was observed by replacing grass silage with press cake silage compared to grass silage only.
- Nitrogen excreted in the milk increased, but N and P excretion decreased in press cake feed compared to grass silage. Nitrogen use efficiency (NUE) increased in press cake compared to grass silage.
- Dry grass protein concentrate performed better than the control diet in terms of daily intake and weight gain in weaner pigs, replacing soybean meal and barley.
- The dried and pelletised protein-rich liquid grass juice can be used to supplement pigs' diets, resulting in improved feed intake and weight gain while reducing reliance on imported soya of up to 50%.
- Dry grass protein concentrate was quite comparable to soybean meal and other protein sources from the compositional analysis.



Supplementing pigs' diets with protein concentrate dried grass juice, improves weaner pig feed intake and weight gain



### Current Status

The project demonstrated the feasibility of this innovative business model for farm diversification in the circular economy. This innovation is at a pilot stage. Individual or groups of farmers or contractors would have capacity to take up the technology.



More information can be accessed at the home page of the Operational Group **Biorefinery Glas**

# Livestock Farming **Good Practices to Enhance Water Quality**

The main objective of Duncannon Blue Flag and Communities Scheme is to decrease bacterial contamination originating from agriculture in the Duncannon catchment that discharges into Duncannon Beach. The scheme is to reduce nutrient discharges from livestock, agricultural and domestic sources. This should contribute to the recovery and long-term retention of the Blue Flag status at Duncannon beach. The scheme focuses on addressing rural point sources of faecal (and associated phosphorus) contamination. However, it does this within a framework of integrated catchment management, whereby a range of pollution sources and types are considered in unison, for multiple benefits in an integrated, holistic manner. A total of 35 farmers participated in this project, encompassing four dairy, eight tillage, and 23 drystock farmers, covering an extensive area spanning over 975 hectares. Rewards based Pollution Potential Zone (PPZ) maps were utilised to evaluate farm conditions and management practices. Farmers were empowered to select and implement measures tailored to their livestock farms. Several water protection improvement measures were successfully implemented.



Water troughs moved 20m from waterways to reduce leaching



# Livestock Farming Good Practices to Enhance Water Quality

## Benefits

- Positive relations between the farmers and householders in the catchment area and the local natural landscape, particularly the water environment were fostered
- The development of reward-based farm-specific PPZ maps which can be used as education and engagement tools to show farmers in a simple visual way, the water-quality risks specific to their farms.
- Demonstration and training on a range of innovative and cost-effective farm management practices for water-quality protection.
- A template for a water-quality-focused, results-based reward scheme which could be used to improve water quality in particularly sensitive catchments.
- A dedicated sustainability manager led the farmers to evaluate and choose which measures to implement or apply to achieve results, also from a cost-benefit point of view.
- Fencing off 15.5 km of watercourses to preserve water from faecal contamination.
- Moving water troughs 20 m from waterways to have a filter area to reduce nutrient leaching into waterways.



Water protection and improvement measures were implemented on participating farms in the Duncannon region



## Current Status

This cooperation project provides pilot-based evidence that the methodologies developed for results-based land payments in protecting water courses and biodiversity are transferable and can protect other resources such as water quality and rural tourism assets.



More information can be accessed at the home page of the Operational Group **Duncannon Blue Flag Farming & Communities Scheme**

## Summary

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### Tools That **Help Farmers to Apply Good Practices to Reduce Environmental Impact**

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- Tool to evaluate the environmental benefits of reducing emissions by applying different Best Available Techniques (BATs) to the breeding phase and supporting farmers in understanding which ones best apply to their reality.

### Technologies and Recommendations to **Improve Nutrient Efficiency in Livestock Farming**

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- BAT technologies that reduce ammonia in pig stables converting it to ammonium sulphate fertiliser and increasing animal welfare.
- Innovative biorefinery approach converts freshly harvested grass into an optimised protein fibre feed for cattle and a non-GMO protein liquid concentrate feed for pigs, improving nutrient efficiency and reducing the carbon footprint of livestock.
- Developing and putting into practice an effective model to restore, protect and enhance water quality for future catchments to foster positive relations between farmers and households.

## **Social and Environmental Benefits Thanks to More Sustainable Livestock Farming**

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- Efficient and affordable innovations to reduce ammonia and GHG emissions from livestock housing and, at the same time, to improve animal welfare and workers health
- External European feed source, like soya, is typically imported from South America. Innovations will be promoted to enhance new local feed sources for reducing transport costs, social and environmental impact and increasing the European circular economy.
- The Duncannon Blue Flag Farming & Communities Scheme has been effectively put into practice and the recommendations and methodology set-up can help to resolve similar issues in other river basins.



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## Project partners



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