

Carbon Footprint Reduction Through Optimized Feeding and Manure Management



Thematic area:

Environmental Sustainability.

Priority: Management of resources and adaptation of practices to climate changes.

Need: Ecological footprint of farms: what practices to reduce it on our farms?; What are the negative impacts of the sector on climate change, and how can they be limited?

Solution EU number: CC-02.

Content of the solution:

Reducing the carbon footprint by paying attention to feeding and manure management

Reasons for Implementing the Solution

Reducing the carbon footprint of farming through optimized feeding and manure management directly lowers greenhouse gas emissions while improving resource efficiency and reducing costs. It also supports sustainable farming and compliance with climate targets.

Description of Solution Strategies

The carbon footprint of agricultural systems is significantly is largely determined by feed production, concentrate use, and manure management. To achieve meaningful reductions, several complementary actions can be implemented:

- Improve feed conversion at the system level: Produce fodder on the farm and make optimal use of it in rations or source it as locally as possible.
- Use feeds that promote soil carbon sequestration: Permanent grassland should be promoted.
- Ensure that manure substitutes synthetic fertilizers, reducing the need for chemical inputs.
- Explore the use of manure for bioenergy production when possible.
- Plant and maintain hedgerows to enhance carbon storage.

Effective manure and urine waste management is crucial to minimize nutrient leaching into groundwater and reduce risks to livestock, human health, and the environment. A circular economy approach can be adopted by optimizing resource management, such as water (stock management), energy (autonomous energy production), and organic inputs (manure reuse).

Reducing the carbon footprint by improving feed and manure management is a critical strategy for addressing climate change and environmental degradation. One key reason to implement these practices is the direct reduction of greenhouse gas emissions. Furthermore, economic incentives exist as farms can save costs on synthetic fertilizers by using manure as a natural alternative. This strategy also supports sustainable farming practices, promoting

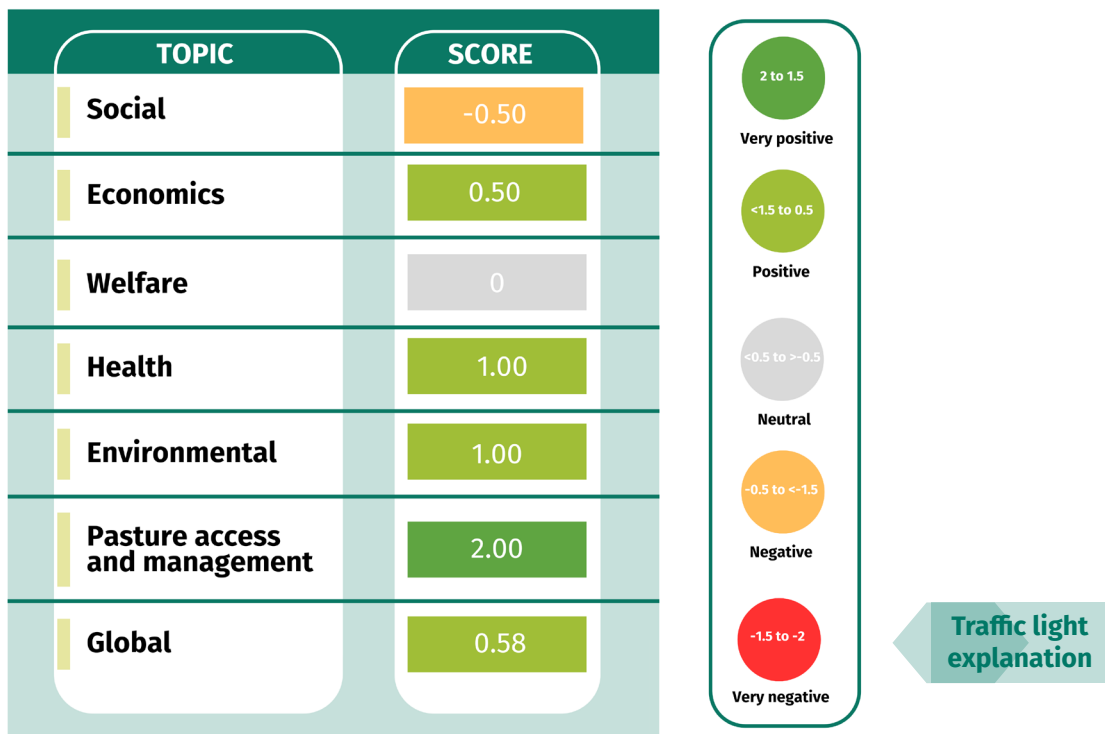


soil health and contributing to carbon sequestration, which helps mitigate the impacts of climate change. The adoption of such measures also aligns with environmental protection goals, such as preventing nutrient leaching and water pollution. Finally, leveraging manure for bioenergy production enhances energy independence and fosters the use of renewable energy sources

Implementation Steps

- 1. Assess current feeding and manure practices** to identify inefficiencies and emission sources.
- 2. Optimize feed production and sourcing** by increasing on-farm fodder production and adapting rations to improve feed conversion.
- 3. Improve manure storage and handling** using covered facilities or slurry separation to reduce CH₄ and N₂O emissions.
- 4. Apply manure as fertilizer strategically** based on nutrient plans to replace synthetic inputs.
- 5. Integrate manure into biogas systems** where feasible to produce renewable energy.
- 6. Monitor key indicators** (feed conversion, fertilizer substitution, GHG emissions) for continuous improvement.

How Will this Solution Impact the Performance of your Farm?



Socioeconomics: This solution will weaken the social performance of the farm because it has little effect on social outreach while increasing the workload for farmers. Managing manure and producing forage demand more labor, which can reduce quality of working life and create a perception of higher burden without clear social benefits.

This solution will support the economic performance of the farm because it reduces the need for external purchases and can improve profitability over time. However, local sourcing may be more expensive and capital investment in machinery for forage production and manure management requires financial capacity. Overall, the long-term savings and efficiency gains can outweigh the initial costs, strengthening economic resilience.



Health & Welfare: This solution supports the health performance of the farm by paying attention to and, where possible, reducing CH₄ and N₂O emissions that may negatively affect the general health of equines. Moreover, improved stable and pasture hygiene through optimized manure management, may contribute not only to reduced emissions, but potentially to the reduction of parasite and pathogen risks so helping the animals to maintain low levels of pain, mortality, and drug use. This solution has no direct effect on the farm’s welfare performance as it does not directly improve housing conditions or the emotional state of animals.



Technical Sheet for Solution Implementation

Carbon Footprint Reduction Through Optimized Feeding and Manure Management



Environmental sustainability: This solution will support the environmental performance of the farm because it supports mitigation of climate change by decreasing farm’s carbon footprint and better manure management equals better quality of water. This solution will support the land access or management performance of the farm due to better management of soil.

How Will this Solution Impact the Resilience of your Farm?

TOPIC	SCORE
Social	-0.25
Economics	-0.08
Welfare	0
Health	0.33
Environmental	0.67
Pasture access and management	0.17
Global	0.18

2 to 1.5
Very positive

<1.5 to 0.5
Positive

<0.5 to > -0.5
Neutral

-0.5 to <-1.5
Negative

-1.5 to -2
Very negative



Socioeconomics: This solution will not impact social performance of the farm facing external challenges assessed because its influence on outreach and social trust is limited. While it may indirectly reduce health issues for horses by improving forage quality, it requires more labor and places greater pressure on working conditions. Limited grassland access could further restrict turnout and welfare, highlighting trade-offs that weaken social outcomes.

This solution will not impact economic performance of the farm facing external challenges assessed because benefits are counterbalanced by significant costs. On the positive side, self-sufficiency reduces dependency on external inputs, lowers exposure to price inflation, and decreases disease risks through fewer external movements. However, higher workloads, substantial investments in machinery, and strong dependence on weather conditions limit the overall financial advantage.

In situations of limited land, prioritizing forage production over horse turnout may also lead to indirect costs related to health and management.

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Health & Welfare: When the farm faces external challenges, its health performance will be only minimally supported by this solution, as it can potentially improve the general health state. This solution may not directly enhance the welfare performance of farms facing all external challenges. While increased health resilience can be expected in the long term, the use of this solution does not necessarily translate into an improved emotional state of the horses or better living conditions when various external pressures are present.



Environmental sustainability: This solution will support the environmental performance of the farm facing external challenges assessed especially related to climate change adaptation and mitigation and water management. This solution will not impact land access or management performance of the farm facing external challenges assessed because there is an access to forage even if costs explode.

How can this solution help your farm to face specific external challenges to be more resilient?

CHALLENGES	SCORE
Inflation	0.42
Pandemic	0.42
High welfare standard	0.33
High infectious diseases	0.50
Extreme weather event	-0.17
Loss/limited access to grassland	-0.33



Inflation & Social Crises: This solution will not impact the global performance of the farm facing inflation or pandemics because the benefits are offset by significant constraints. While self-sufficiency can reduce dependence on external inputs, ease access to forage, and limit some costs, these positive effects are counterbalanced by



Technical Sheet for Solution Implementation

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greater labor demands and the need for costly machinery. As a result, resilience gains during inflation or pandemics remain marginal, with no decisive improvement in the farm's overall performance.



Welfare & Diseases: This solution has little effect on the global performance of the farm facing infectious disease since it translates just minimally onto the health and resistance of animals. This solution will also not impact the global performance of the farm facing high welfare standards because it may hard to assess its direct effect on equine welfare like welfare-friendly housing.



Climate Change & Access to Land: This solution will not impact environmental performance of the farm facing abnormally high temperatures and/or draught because it has several diverse effects. It depends a lot on the weather, so low forage yield due to lack of water could affect negatively equine welfare and health, working conditions and profitability of the farm. On the other hand, it does have a positive impact on climate change mitigation and water management.

This solution will not impact land access or management performance of the farm facing external challenges assessed because it has diverse effects. If the farm does not have enough land to produce forage and turn equines out, it can be difficult to find alternative feed. If the land is used for forage production this can lead to equine health issues. Either way there are negative effects on social outreach, profitability and equine welfare and health. This solution has a positive effect on water and soil management if the farmer decides to stabilize surface to turn out equines, and keep the land for forage production.

Cost-benefit Analysis

Costs

Socioeconomics:

- Investment in improved manure storage or biogas systems.
- Possible costs for feed ration optimization and analysis.

Health & Welfare:

- Minimal; feed adjustments may require ration changes.
- Uncertainty how to measure effect on the animal welfare.

Sostenibilidad medioambiental:

- Potential nutrient losses if manure is not perfectly managed.
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Cooperation between farms

- Coordination effort for joint manure use or shared biogas facilities.



Benefits

- Reduced expenses for synthetic fertilizers through manure use.
- Potential revenue from biogas/renewable energy production.
- Improved long-term soil fertility, reducing future input needs.

- Potentially more stable and diverse forage quality due to increased permanent grassland.
- Improved stable and pasture hygiene through optimized manure management, reducing parasite and pathogen risks.

- Significant reduction of CH₄ and N₂O emissions.
- Lower nutrient leaching → improved water quality.
- Increased soil carbon sequestration via grassland integration.
- Higher biodiversity and forage quality from permanent grassland use.
- Contribution to climate change mitigation and biodiversity protection.

- Shared infrastructure can reduce individual costs (e.g., communal biogas plants).
- Better nutrient distribution between farms with surplus and deficit areas.
- Knowledge exchange fosters innovation and resource efficiency.



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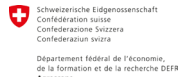
Additional Resources

Publications

- Dangal, S. R. S., Tian, H., Pan, S., Zhang, L., & Xu, R. (2020). Greenhouse gas balance in global pasturelands and rangelands. *Environmental Research Letters*, 15(10), 104006. <https://doi.org/10.1088/1748-9326/ABAA79>
- Karasu, G., Rogers, Chr., Gee, E. (2023). Dietary Transitions Toward Sustainable Horse Feeding. *Journal of Equine Veterinary Science*. 128. <https://doi.org/10.1016/j.jevs.2023.104880>
- Petersen, S. O., Blanchard, M., Chadwick, D., Del Prado, A., Edouard, N., Mosquera, J., & Sommer, S. G. (2013). Manure management for greenhouse gas mitigation. *Animal : an international journal of animal bioscience*, 7 Suppl 2, 266–282. <https://doi.org/10.1017/S1751731113000736>

Website

- Rules to store and use manure in France: <https://equipedia.ifce.fr/infrastructure-et-equipement/installation-et-environnement/effluents-delevage/regles-de-stockage-et-d-epandage-du-fumier-de-cheval>
- Management and valorisation of manure: <https://equipedia.ifce.fr/infrastructure-et-equipement/installation-et-environnement/effluents-delevage/demarche-ecoresponsable-pour-la-gestion-et-la-valorisation-du-fumier-equin>
- Pasture management: <https://equipedia.ifce.fr/elevage-et-entretien/alimentation/gestion-des-prairies>



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Ideas to Animate a Workshop About the Solution

- Ask traders/advisors/companies specialized in feeding, manure management, or sustainable farming to sponsor the workshop.
- Find a model farm where the workshop can take place.
- Complete practical tasks and let participants take part in these demonstration tasks so they can experience the system first-hand.

Proposed Structure for the workshop on Reduction of Carbon Footprint through optimized Feeding and Manure Management in Equine Farms

1. Introduction to Feeding and Manure Management for Carbon Footprint Reduction

- What is sustainable feeding and manure management?
- Key components: locally produced feed, permanent grassland, organic fertilization, efficient manure storage.
- Overview of available solutions (e.g., feed optimization software, biogas systems, improved storage techniques).

2. Benefits of Sustainable Feeding and Manure Management

- Reduction of greenhouse gas emissions (CH₄, N₂O).
- Cost savings due to reduced need for synthetic fertilizers.
- Improved soil and forage quality → indirect benefits for equine health.
- Promotion of biodiversity and sustainable resource use.

3. Practical Applications on Equine Farms

- Using locally produced feed and integrating permanent grassland.
- Manure management: effective storage, regular application, potential for biogas production.
- Examples of practical implementation in stables and pastures.

4. How to Choose the Most Suitable Practices

- Evaluation of farm-specific needs and available infrastructure.
- Comparison of different technologies and approaches (e.g., composting vs. biogas, feed analysis).
- Cost-benefit assessment and available subsidies.

5. Hands-On Demonstration

- Demonstration of forage samples and quality analysis.
- Visit to a manure storage facility or a biogas plant (on-site or virtually at a model farm).
- Participants try out feed composition adjustments or composting techniques.

6. Maintenance and Troubleshooting

- Regular monitoring of storage conditions and feed quality.
- How to deal with issues such as odor, nutrient losses.
- Tips for maintaining biogas systems or storage facilities.



7. Case Studies and Real-World Examples

- Examples of equine farms that have successfully improved feed and manure management.
- Presentation of savings and environmental effects.
- Discussion of challenges and solutions.

8. Cost Analysis and Return on Investment (ROI)

- Investment costs for improved storage, equipment or manure spreading (tractor and spreader), feed analysis, or biogas systems.
- Savings from reduced fertilizer use and possible energy production.
- ROI calculation in terms of farm costs and environmental benefits.

9. Q&A Session

- Open discussion of practical challenges, costs, and experiences.
- Exchange on regional conditions and available support programs.

10. Wrap-Up and Resources

- Summary of key takeaways.
- Further resources (websites, brochures, advisory services).
- Information about possible partnerships or funding options.