Mitigating enteric methane emissions through feeding practices

POLICY NOTE

September 2024

Key messages

1. Improving feed reduces the level of animal emissions (methane/kg product), while improving productivity.
2. Supplementing rations with locally available products is an effective mitigation option for enteric methane emissions.
3. Producing original and contextualized references helps to improve the assessment of livestock sector contribution to greenhouse gas emissions in sub-Saharan Africa.

Context

Ruminant livestock farming is considered a major emitter of greenhouse gases (GHG), accounting for more than 65% of GHG emissions from the livestock sector worldwide. In extensive livestock farming (pastoral and agro-pastoral) in sub-Saharan Africa (SSA), animal productivity is low and therefore emission intensities are proportionally high.

One of the causes is the deficit in quantity and quality of feed resources, particularly during the dry season, which does not allow optimal functioning of digestion in the rumen.

The dietary strategies suggested in the international literature for GHG reduction are often not adapted to the SSA context because they involve expensive and locally inaccessible inputs.

Sometimes these GHG reduction strategies also involve a reduction in animal productivity, and do not necessarily use local resources. However, in agro-pastoral systems, livestock farmers have access to a variety of crop by-products and agro-industrial co-products such as oilseed cakes, spent grains or brans.

GHG emissions can be expressed in several ways

Gross emissions are expressed in g of methane (CH_4) per animal per day or in kg of CH_4 per animal per year.

When we want to study the efficiency of processes and systems optimization strategies in more detail, it is preferable to relate emissions either to ingestion (we then speak of methane yield) or to the quantity of product – milk or meat – (we then speak of methane production intensity).

A dietary strategy that increases the quantity and quality of the ingested feed will lead to an increase in gross emissions, but also to an improvement in the efficiency of resource use, characterized by a decrease in emission intensity or methane yield.

Find out more about the CaSSECS project

Methodology

Crop by-products used in ruminant feed

Crop by-products available to supplement rations were identified through surveys of agro-pastoralists: these are mainly cereal straws (sorghum, millet, corn and rice) and legume tops (peanuts and cowpeas).

Another local resource is the leaves of spontaneous or cultivated fodder trees and shrubs, which are traditionally used by pastoralists in periods of low fodder availability, particularly at the end of the dry season when herbaceous plants are no longer present.

A bull calf during measurements of enteric methane emissions (GreenFeed® device). Experimental platform of CIRDES (Burkina Faso) installed by the CaSSECS project for direct measurements of enteric methane in cattle

Results

Impact of different groups of crop by-products on enteric methane emissions

Within the framework of the CaSSECS project, trials were carried out on cattle to measure the production of enteric methane associated with different rations, supplemented or not, with these crop by-products and locally available woody fodder.

Cereal straws in the ration

Cereal straws, which are very abundant in agro-pastoral systems, have a low nutritional value. However, when they were associated with diets consisting of natural rangeland grasses, which are of very low value during the dry season, the level of ingestion was higher and there was a slight decrease in enteric methane emissions.

Woody fodder in the ration

The dried leaves of shrubby legumes, although rich in lignin and tannins, are consumed well by animals. Their high protein content improved rumen function and significantly reduced methane yield.

Legume tops in ration

Legume tops have a higher nutritional value, particularly due to their higher protein content. Combined with rangeland grasses, they had a marked positive effect on animal performance, improved the ingestion and digestibility of rations and significantly reduced methane yield.

The importance of rebalancing rations

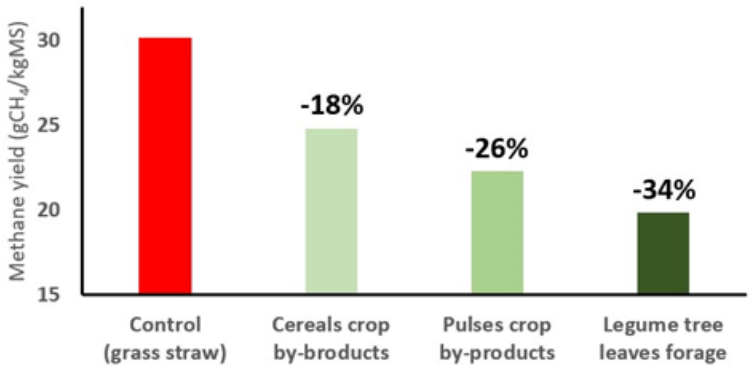
All these results show that it is crucial to improve the balance of rations to fill the deficit in quantity and quality of basic fodder during the dry season in SSA. Supplementing with local resources had a direct positive effect on rumen functioning and helped to reduce methane yield.

The results were obtained from resources known and used by breeders in ruminant feeding. However, the challenge is to make these resources available in the places and periods where supplements are necessary and therefore it is necessary to develop storage/conservation or transport strategies.

Impact of feeding supplements on methane yield

Tests have shown that methane yield is reduced by supplementing rangeland grasses, regardless of the nature of the supplements distributed.

However, resources richer in nitrogen increase methane production, which can represent up to a third of the methane yield.



Conclusion

Feeding supplements makes it possible to jointly improve animal productivity and the environmental impact of livestock production systems in SSA, this in a context where the amount of crop residue increases with the increase in cereal-cultivated areas. These improvements can be coupled with strategies aimed at promoting the use of effluents for organic fertilization of crops as a viable agro-ecological practice in SSA.

Recommendations

1. Straw use should be optimized by implementing storage strategies for use during key periods. It can also be improved by technological interventions such as chopping or adding urea.
2. It is necessary to disseminate good practices for preserving legume tops because good drying and storage conditions preserve the proteins in the leaves.
3. The use of woody plants must be encouraged by the introduction of agro-ecological practices such as hedgerows or the establishment of shrub fodder banks.
4. Reliable data on methane emissions must continue to be produced to support national GHG inventories better and to fully understand the biological mechanisms involved.

Bibliography

Gbenou G. X., Assouma M.H., Zampaligre N., Martin C., Bastianelli D., Bonnal L., Kiendrebeogo T., Sib O., Bois B., Sanogo S. & Dossa L.H. 2024. Mesurer, prédire et réduire les émissions de méthane entérique en Afrique subsaharienne. INRAE Prod. Anim., 37 (1): 7648. https://DOI:10.20870/productions-animales.2024.37.1.7648

Gbenou G. X., Assouma M. H., Bastianelli D., Kiendrebeogo T., Bonnal L., Zampaligre N., Bois B., Sanogo S., Sib O., Martin C. & Dossa, L.H. (2024. Supplementing zebu cattle with crop co-products helps to reduce enteric emissions in West Africa. Archives of Animal Nutrition, 1–17. https://DOI:10.1080/1745039X.2024.2356326

Contacts

Authors

Assouma M. H.*, Bastianelli D., Dossa L. H., Gbenou G.X., Martin C.

* habibou.assouma@cirad.fr

CaSSECS partners

Funded by

UNION EUROPEENNE

Sahelian livestock carbon footprint

THE PROJECT

Context

The Paris Agreement strengthened the global climate effort by requiring signatory countries to set climate targets for reducing greenhouse gas (GHG) emissions. Thus, the member states of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) have undertaken to provide national inventories supported by **data reports on their GHG emissions and absorptions from all sectors**. According to current estimation models, **GHG emissions from ruminant livestock farming in (agro) pastoral systems** would represent a **significant share of total GHG emissions** in many developing countries, and they are expected to increase over the coming decades. These systems are indexed as significant emitters in particular due to **insufficient data, benchmarks and reliable scientific and technical skills**. The sustainability of these ecosystems is now threatened even though they offer multiple benefits and services (social, economic, cultural) to the populations of the Sahel.

Areas of work

1. Production of reference data on GHG emissions and carbon storage
2. Improvement of the carbon footprint device at the national level
3. Co-design and dissemination of options for mitigating the impact of livestock farming on climate change
4. Strengthening skills in assessing the environmental impact of livestock farming systems
5. Coordination, dissemination, communication and monitoring-evaluation

In short...

- **Participants involved**

The project involves more than 100 researchers and teacher-researchers. It finances 10 doctoral theses and around forty master's internships.

- **Target groups:** technical agents of States and NGOs, inventory managers, decision-makers, researchers and teacher-researchers, organizations and professional associations of pastoralists and agropastoralists.
- **Final beneficiaries:** pastoral and agro(pastoral) households.

- **Budget**: 5 million euros

- **Duration:** 5 years (2020-2024)

- **Donor:** European DeSIRA Program - EU

Project objectives

General objective

Improve the assessment of the carbon footprint of Sahelian (agro)sylvopastoral ecosystems to better quantify their impacts on climate change for the development of livestock policies adapted to the Sahel.

The results obtained

- National and regional devices for **producing and updating reference data** on GHG emissions and the carbon storage potential of (agro)sylvopastoral ecosystems are strengthened and operational;
- **Multi-scale carbon footprint assessment tools** are developed and contribute to national inventories, to the drafting of IPCC's reports and to livestock development policies;
- **Innovative options for sustainable GHG mitigation** are co-designed, tested and validated with (agro)pastoralists;
- The **skills of stakeholders in carbon footprint assessment are strengthened** and the common vision of interinstitutional dialogue is renewed.

Three target countries:
Burkina Faso, Niger and Senegal
Extension to CILSS countries

Useful and usable results

The attached policy and technical notes are intended to facilitate the circulation of information and exchanges between:

Inventory managers: learn about new measurement and analysis tools to contextualize inventory data and advance the region's technical capacities.

Decision-makers: rely on research to comply with the international transparency framework and have arguments to defend Sahelian (agro)pastoral livestock systems.

Researchers: understand the research underway in the region for more resilient (agro)pastoral livestock systems.

CaSSECS video

@ProjetCassecs @ProjetCaSSECS @projetcassecs6119

Some tools and devices

GreenFeed® – device for measuring enteric methane emissions

IRS – carbon chemical composition of rations and soils

Drones – study of vegetation dynamics

GPS collars - demographic monitoring of transhumant animals

Modelling of GHG flows

CaSSECS partners

Funded by

UNION EUROPEENNE