

Reducing enteric methane emissions via low-methane forages

THE CHALLENGE

Agrifood systems account for roughly one-third of all greenhouse gas (GHG) emissions globally, when food production, transport, processing, and retailing are considered (Crippa et al. 2021; IPCC 2022; Costa Jr et al. 2022). Methane emissions account for 35% of agrifood system GHG emissions (expressed in CO₂e) consistently across developed and developing countries (Crippa et al. 2021), with livestock production being the most significant contributor. Indeed, livestock emissions from manure and enteric fermentation represent 32% of all global anthropogenic emissions of methane (Global Methane Assessment 2021).

Methane is an extremely powerful GHG, and the need for action is urgent. Unlike carbon dioxide, which stays in the atmosphere for hundreds of years, methane starts breaking down quickly, with most of it gone after a decade. This means cutting methane emissions now can rapidly reduce the rate of warming in the near term.

HOW DO LOW-METHANE FORAGES HELP US REDUCE EMISSIONS FROM LIVESTOCK?

Climate Action Tracker have set the 1.5°C-aligned target for agricultural production emissions as a 39% absolute reduction by 2050 relative to 2017 (Climate Action Tracker 2023). They note that, as global population and food demand are projected to continue growing through at least the year 2050, the emissions intensity of agricultural production per calorie of food produced will need to fall even faster than this 39% absolute target. Rapidly reducing the emissions intensity of livestock is therefore critical by 2030.

One way to reduce methane emissions from the digestive process of ruminant animals, such as cattle, sheep, and goats, is through the development of low-methane forages. Improved forages, including legumes and grasses enriched with anti-methanogenic compounds (AMC) such as tannins, saponins, or flavonoids, offer a potentially cost-effective solution for reducing methane production from livestock systems, both pastoral and cut-and-carry (Bratta 2015). These compounds can reduce methane emissions by inhibiting methanogenic microbes in the rumen and altering the microbial community to favor alternative fermentation pathways that produce less methane without negatively affecting animal productivity (Molina-Botero et al. 2024; Arndt et al. 2022).

In addition to reducing enteric methane emissions, low-methane forages could have several other environmental benefits, including improved [carbon sequestration](#) in soil and enhanced [soil health](#), with the potential for developing land-based GHG removal projects (Costa Jr et al. 2022; Paul et al. 2020).

Ongoing research and development (R&D) efforts aim to identify and develop high-yielding, nutritious, and drought-tolerant low-methane forages to improve animal productivity and decrease enteric methane emissions through enriched AMC. These R&D efforts are focusing on three key areas:

- Identifying and promoting low-methane forage legumes with high levels of AMC directly into ruminant production systems in the global South.
- Breeding a methane emission-reducing trait into widely used forage grass cultivars and major cereals with feed value from silage and crop residues, either through conventional or precision breeding (gene-editing) approaches.
- Enabling deployment of low-methane forages into forage-based livestock (ruminant) systems in the global South.

BARRIERS TO UPTAKE OF LOW-METHANE FORAGES



High upfront costs, which include:

(i) working capital for planting improved forages and purchasing animals; (ii) capital investments in infrastructure, such as corrals, barns, and fencing; and (iii) opportunity costs of land and labor, which could limit adoption by some resource-poor farmers (Micol & Costa Jr 2023; White et al. 2013).



Supportive public policies and agreements between governments are often lacking (Micol & Costa Jr 2023; White et al. 2013).



More climate finance (e.g., grants, credit lines, impact funds, and carbon markets) is needed to de-risk investments and incentivize farmers (Gerber et al. 2021).



Farmers may also require training to effectively manage new systems involving low-methane forages.



A one-size-fits-all approach would not be effective, because solutions need to be tailored to specific regions, e.g., for adaptation to local soil and weather conditions.



CALL TO ACTION

A1. Increased international climate finance should be directed toward unlocking the potential of agricultural technologies and approaches with proven effectiveness

- Include low-methane forages in Climate Bonds Initiative (CBI) Agriculture Criteria – under efforts to reduce GHG emissions, where the science has been proven – so that they are eligible for green finance. This in turn should be used to include low-methane forages in country- and regional-level taxonomies, e.g., the EU taxonomy of permissible activities for green finance.
- Encourage multilateral development banks (MDBs) and donor countries to provide concessional loans and grants for low methane forages where there are large opportunities for productivity improvement as well as reducing emissions, but upfront costs are a barrier to action. Such financing will also incentivise the development and scaling of carbon markets and impact financing with the private sector, create special credit lines within banking systems, and establish blended-finance mechanisms that combine public and private investments.
- Seek and obtain international consensus on “repurposing” the more than US\$600 billion spent annually by governments on agricultural support. Considering that much of the support provided to agriculture is market-distorting and incentivizes unsustainable production, public support should be reformed. One of the most promising shifts in such investments would be an increase in funding for R&D dedicated to productivity-enhancing and emissions-reducing technologies.

A2. Promote international sharing of knowledge on policy and implementation to facilitate faster uptake of proven technologies

- Countries should take advantage of the existing Methane Pledge and incentivise demand creation globally for low methane forages through specific technology use pledges and targets. These can be supported by financial incentives including carbon off-setting and national tax incentives to encourage producer uptake of technologies and consumer purchase of low-methane dairy and meat. As supply increases and the enabling environment improves, regulation forcing use of these emission-reducing technologies can be considered.
- Countries should take advantage of existing platforms such as the World Bank and FCDO facilitated Global Agriculture Policy Dialogues to engage in intensive exchanges of knowledge on questions such as which policies are most effective for encouraging and supporting farmers’ adoption of low methane forages to facilitate knowledge exchange and learning.

A3. Develop common metrics and indicators to track the adoption of sustainable agricultural solutions

- Develop and standardize cost-effective methodologies for evaluating standards for low-methane forages across diverse socioeconomic and environmental contexts. This involves collaboration with research institutions and international organizations such as the Organisation for Economic Co-operation and Development, International Organization for Standardization and carbon market standards (e.g., Verra, Gold Standard, Plan Vivo).
- Countries should come together and develop “[Codex Planetarius](#)” on the lines of Codex Alimentarius which develops internationally agreed food safety standards. ‘Codex Planetarius’ can set forth criteria for crops and animal-derived products (that is, end products for consumption) to be certified as compatible with international climate targets, which will then incentivise all actors in the value chain, such as fertilizer and livestock producers, to adopt low emissions and climate compatible technologies.

A4. Increase support for food system research, development, and demonstration to support the uptake and scaling of promising technologies and approaches

- Taking advantage of the active [livestock research group](#) of the Global Research Alliance on Agricultural Greenhouse Gases (GRA), invest in the continued research on low-methane technologies by documenting early success stories and increasing farmer options and market competition. Capacity building is required to undertake necessary research, particularly in low- and middle-income countries. GRA can also act as a global platform to centralize

and facilitate greater sharing of data between public, commercial, scientific, and regulatory bodies for the development of standardized, science-based approaches to measuring product impacts, global standards, metrics, and accounting for methane reduction, including through the use of low-methane forages. Initiatives such as the [Global Methane Hub's Enteric Methane R&D Accelerator](#) provide opportunities for global research collaboration.

A5. International efforts should work toward enabling the private sector to scale up solutions through global markets

- Revive moribund [WTO Agreement on Environmental Goods and Services](#). Plurilateral negotiations for an Environmental Goods Agreement were started in 2014 to promote trade in essential environmental products, i.e., solar panels and wind turbines. In future negotiations, the list of

green goods and services should include low-methane forages. This would involve advocating for harmonized standards, certifications, and accounting methodologies with multilateral organizations such as WTO and various UN agencies.



Cite as:

Arango, J., C. Costa Jr., Flintan, F., S. Marshall, A. Mukherji. 2024. Reducing enteric methane emissions via low-methane forages, *Factsheet #2 of 2024 Breakthrough Agenda Report: Agriculture*, <https://hdl.handle.net/10568/152361>, 4pp

For more information see:

Mukherji, A., Marshall S., Arango, J., Costa Jr, C., Flintan, F., Hebebrand, C., Kihara, J., Masso, C., Molloy, P., Rusinamhodzi, L., Sapkota, T. Vanlauwe, B., (2024). *2024 Breakthrough Agenda Report: Agriculture*, CGIAR, Montpellier, France. <https://hdl.handle.net/10568/152247>. Available at: <https://www.cgiar.org/breakthrough-agenda-report-2024/>