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Productive, environmental, and economic shifts of dairy systems by adopting silvo-pastoral systems and improved pastures

RICARDO GONZALEZ QUINTERO¹, HELVER HERNANDO GARCIA², JESÚS FERNANDO FLOREZ³,
STEFAN BURKART³, JACOBO ARANGO³

¹*The Alliance of Bioversity International and CIAT, Trop. Forages Program, Kenya*

²*Fudacion Alpina, Colombia*

³*The Alliance of Bioversity International and CIAT, Trop. Forages Program, Colombia*

Abstract

In Colombia, milk yield gaps among dairy systems are large and farms with better feed quality and sustainable cattle management practices are more productive. Cattle farming is responsible for about 15 % of the Colombian greenhouse gas emissions (GHGE), therefore, sustainable mitigation strategies for dairy farms can help to reduce the climate impact. Silvo-pastoral systems (SPS) and improved pastures (IP) are recognised strategies to transform dairy systems by enhancing cattle productivity, reducing climate change impact, and increasing farm profitability. This study aims at assessing the climate change impact of small dairy cattle farms and at identifying how the implementation of SPS and IP as sustainable cattle practices (improvement scenario -IS-) can improve milk yields, farm profitability, and reduce GHGE. The study focuses on four very small dairy farms in the Cauca Department in Colombia and uses a life cycle assessment approach to calculate the carbon footprint (CF) of milk production. GHGE were calculated by applying the 2019 refinement to 2006 IPCC guidelines. The functional units correspond to one kg fat and protein-corrected milk (FPCM) and one kg live weight gain, in a cradle-to-farm-gate approach. A biophysical allocation method was applied for handling co-products leaving the farm. The study found that the milk CF ranged between 2.4 and 3.2 kg CO₂-eq kg FPCM⁻¹ in the baseline. On average, in the IS, the area with SPS and IP corresponded to more than 48 % of the total farm area. The above allowed a higher availability of high-quality forage in the IS than in the baseline (no adoption of SPS and IS) and led to an increase in milk yields of up to 38 % with a subsequent reduction of up to 40 % of milk CF (varying from 1.4 and 2.7 kg CO₂-eq kg FPCM⁻¹). The IS also increased incomes by milk sales between 33 to 50 %. The study provides evidence on the positive influence that the adoption of SSP and IP can have on the transformation and improvement of the sustainability of small dairy systems in Colombia. The findings highlight the importance of sustainable mitigation strategies for dairy farms to reduce their climate impact while improving productivity and profitability.

Keywords: Carbon footprint, greenhouse gas emissions, life cycle assessment, mitigation actions