Assessing the environmental impacts of smallholder dairy farming systems in Southern Highlands, Tanzania

Jessica Mukiri, Emmanuel Mwema, Birthe Paul, An Notenbaert
International Center for Tropical Agriculture (CIAT), Tropical Forages Program, Nairobi, Kenya
CONTACT: j.mukiri@cgiar.org

Introduction

Dairy production in Tanzania has not kept up with the demand, presenting an opportunity for smallholder farmers to take advantage of this market. Semi-intensive dairy farming practices can be in the Northern and Southern Highlands, as the agro-ecology there favors these farming practices. Farmers face challenges such as prolonged inter-calving interval, lack of extension services and poor feeding quality and seasonal availability resulting in low milk production[1].

Figure 1. smallholder dairy intensified farming system in Rungwe, Tanzania

At the same time, the environmental footprint (land, soils, water use, GHG emissions) is big. The challenge is how to sustainably intensify dairy production systems which mitigate environmental impacts while continuing to meet smallholder farmers' needs. Integrating improved forages technologies in mix crop-livestock systems can have several benefits, including reducing the ecological footprint and increasing production among others[2].

Objective

The objective of this study is to assess the environmental impacts of improved feeding as a livestock intensification pathway in smallholder farms in the Southern highlands of Tanzania.

Methodology

Farm Typologies and Feed baskets:

» The study sites are Mufindi (Iringa region), Njombe and Rungwe (Mbeya region) (Figure 2).

» 30% of all farmers in the study sites were categorized as "dairy intensifying" (source: ILRI through the Greening Livestock (GL) IFAD project Household survey[3]).

» Average dairy intensifying characteristics include: land holding of 5.3 ha, number of Tropical Livestock Unit 7.5 (~2 improved zero -grazed dairy cows), milk yield 9L during dry season and 10L during wet season.

» 3 representative dairy intensifying farms were selected from the studies participating households.

» Wet and dry season feed baskets of all 3 farms were described using feed gap assessment (Figure 3)[4].

Figure 2. Map of study sites

Environmental Modeling:

CLEANED-X, an Excel based ex-ante environmental assessment tool that assesses multiple environmental dimensions (water, land use, soil health, greenhouse gas emissions) within a livestock enterprise was used[5].

The tool was parametrized for this region using expert data, literature reviews and experimental data.

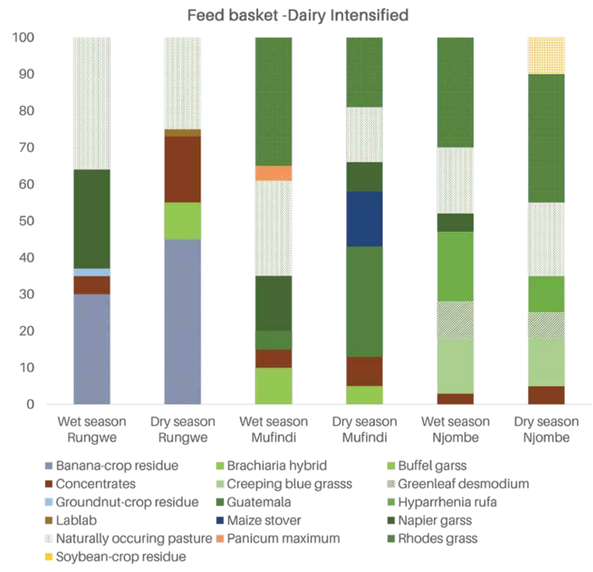

Figure 3. Current feeding practices in wet and dry seasons in the southern highlands

An improved wet season feeding scenario was run with a 10% and 15% increase in milk yield. This constituted changing the feed basket with 15 % of the lowest quality feed replaced with *Brachiaria* hybrid and 10% increase in concentrate feed.

Results

	Land requirements (ha)		Soil impacts						Water impacts						GHG emissions							
			Milk yield increased by 10%			Milk yield increased by 25%			Milk yield increased by 10%			Milk yield increased by 25%			Milk yield increased by 10%				Milk yield increased by 25%			
	Milk yield increased by 10%	Milk yield increased by 25%	Soil mining (%)	Soil leaching (%)	Soil erosion (t/yr)	Soil mining (%)	Soil leaching (%)	Soil erosion (t/yr)	Water milk (m^3/kg milk)	Water meat (m^3/kg meat)	Water/ha (m^3/ha)	Water milk (m^3/kg milk)	Water meat (m^3/kg meat)	Water/ ha (m^3/ha)	GHGTotal (t CO_2 eq/yr)	GHGMilk (kg CO_2 eq/kg milk)	GHGMeat (kg CO_2 eq/kg meat)	GHGha (t CO_2 eq/ha)	GHGTotal (t CO_2 eq/yr)	GHGMilk (kg CO_2 eq/kg milk)	GHGMeat (kg CO_2 eq/kg meat)	GHGha (t CO_2 eq/ha)
Rungwe *Improved wet season feeding scenario*	-	--	+		-	+		-	-	--	-		--	-	-	+	-	+	-	++	--	++
Mufindi *Improved wet season feeding scenario*	+		+		-	+		-	++	+		+++			-	+	-	-	-	++	--	-
Njombe *Improved wet season feeding scenario*	-	-	++		-	++		-	-	-	-	+	--		-	+	-	+	-	++	--	++

Conclusions

» The improved wet season feeding interventions had different effects on the environmental footprints on different farms.

» Intensifying dairy production with improved wet season feeding can mitigate environmental impacts, such as reducing water footprints.

» Improved feeding interventions can have negative environmental impacts such as needing more land which can be a limiting factor.

» Improving wet season feeding when intensifying dairy production had positive impacts on the reduction of GHGe intensities.

» Further feeding scenarios need to be run and results need to be validated by stakeholders.

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