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Environmental co-benefits of improved forages in smallholder dairy systems of Kenya

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The importance of livestock



For PEOPLE

- Employment, income
- Economy
- Food and nutrition
- Cultural value
- Resilience and risk management



And the PLANET

- Biggest land user
- Natural resources:
 - Manure, soil carbon, energy...
 - Water use/pollution, degradation, GHGe...

Sustainability is a big issue and needs to be managed

Optimize the environmental footprint



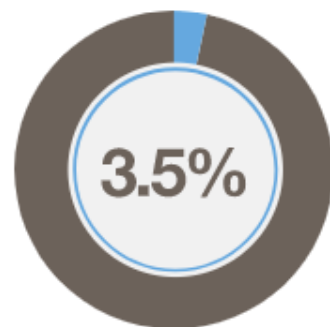
“Good” & “Bad”



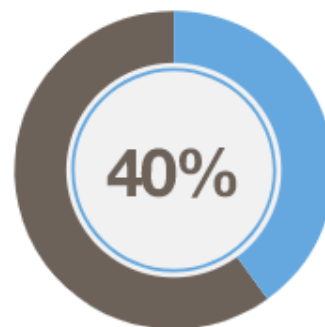
Without compromising the good!

The Kenya case: Rising demand ~ ready market

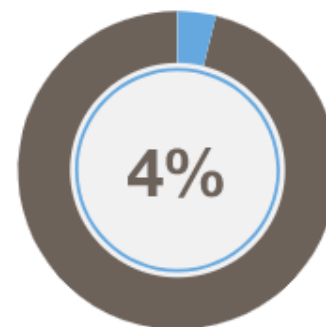
<http://www.kenyamarkets.org/current-sectors/dairy>



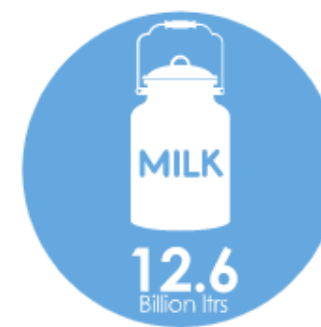
The sector's annual growth rate



Contribution to the agricultural GDP



Contribution to the overall Kenyan GDP



Projected growth in litres by 2030



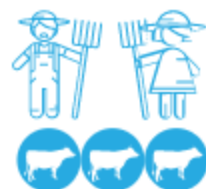
The sector provides direct jobs to over **1.2 million** smallholder farmers



5.2 Billion Litres

Current total milk production (litres/year)
The projected growth is 12.6 billion litres by 2030

Kenya has the second largest market in the dairy industry in Africa



Production is dominated by smallholder farmers with an average of **2-3 cows**.

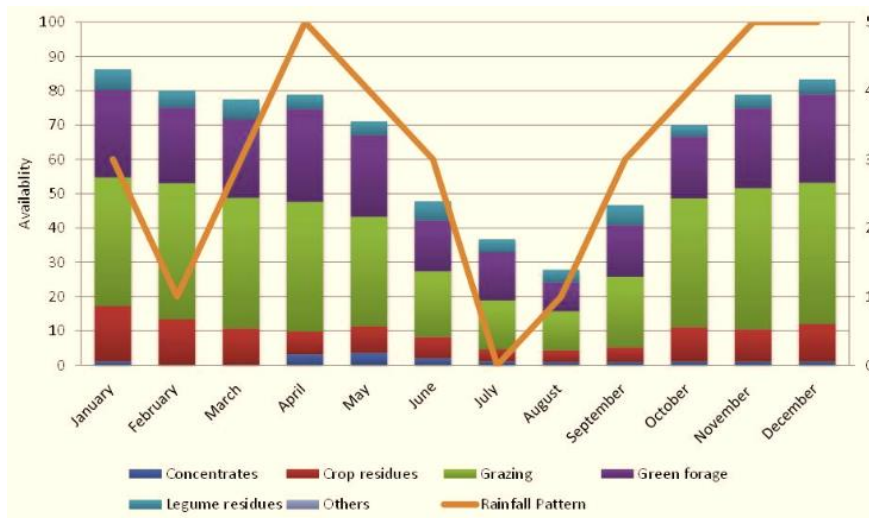
OF LOW PRODUCTIVITY

& emitting ~ 12.3 Mégatonnes (Mt) CO² eq

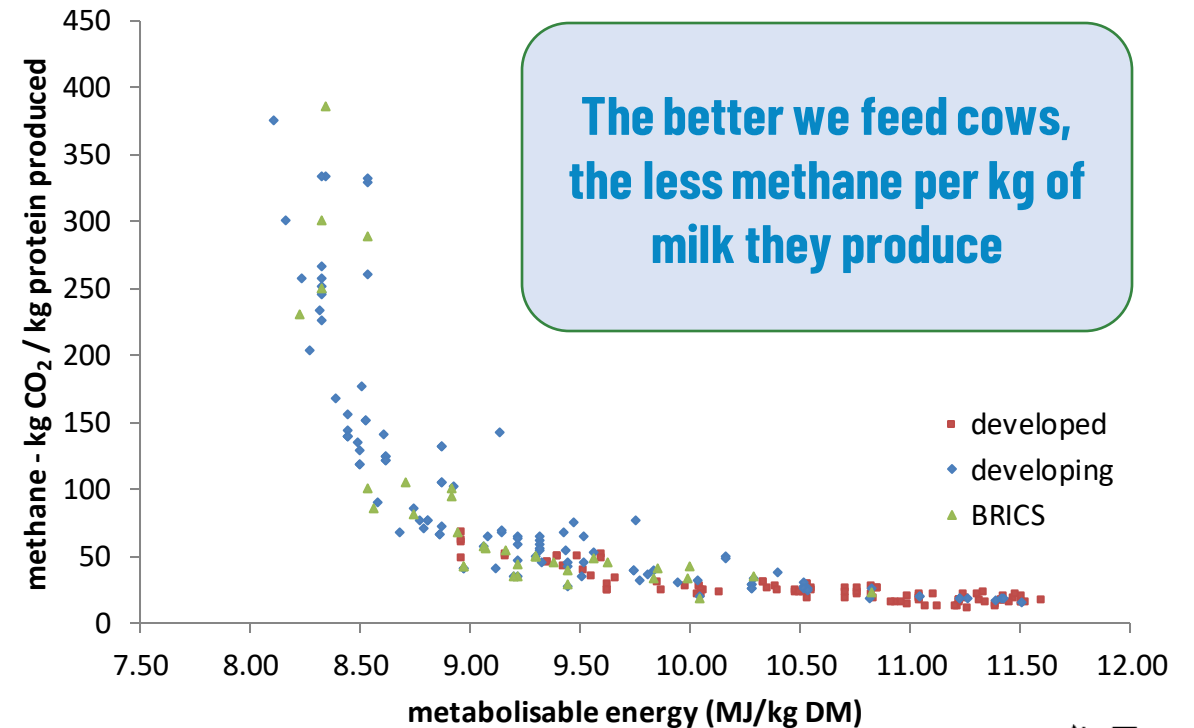
Integrating improved forages in livestock production systems: pitched as **triple-win/climate smart** solution

- ✓ Increasing year-round availability of feed quantity and feed quality (+ CC adaptation).
- ✓ Increasing livestock productivity and efficiency (feed being highest cost driver)
- ✓ Reducing GHGe intensity
- ✓ Improving land productivity

= a true triple-win or climate-smart intervention



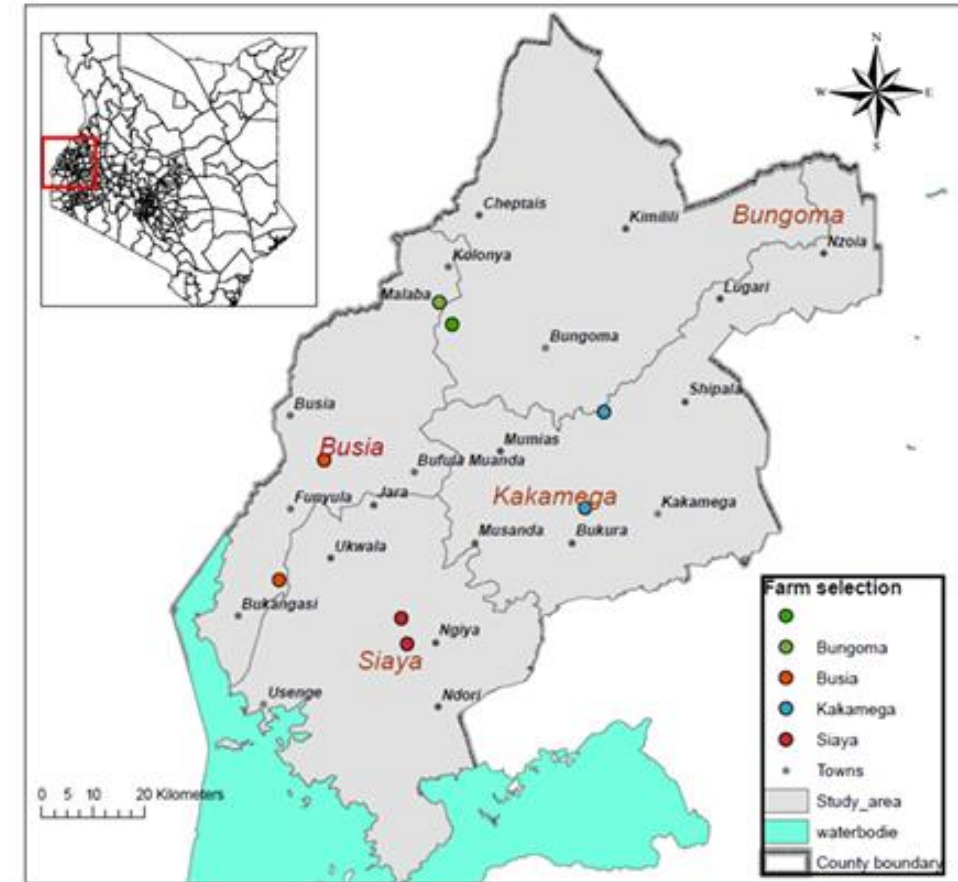
Maass et al, 2013



Herrero et al 2012

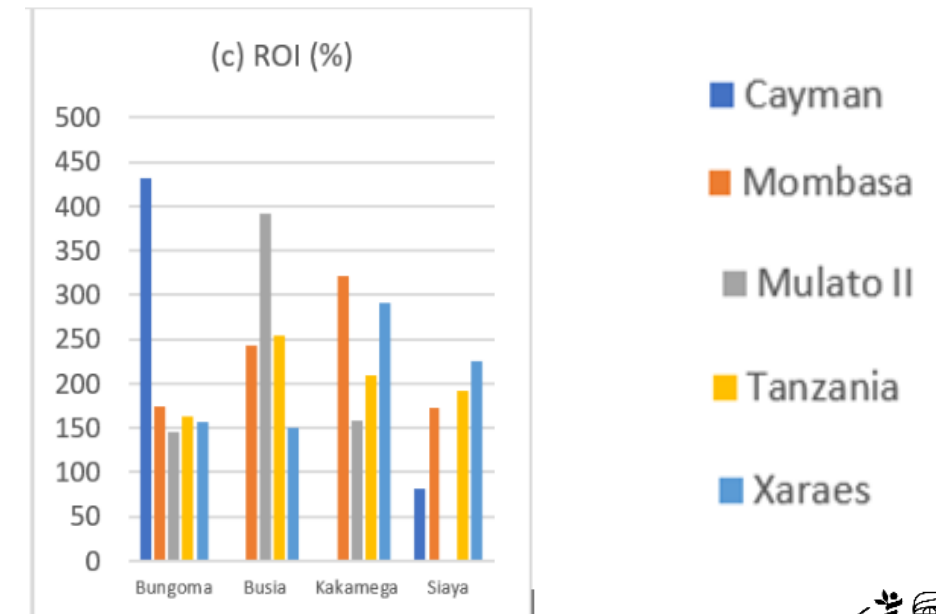
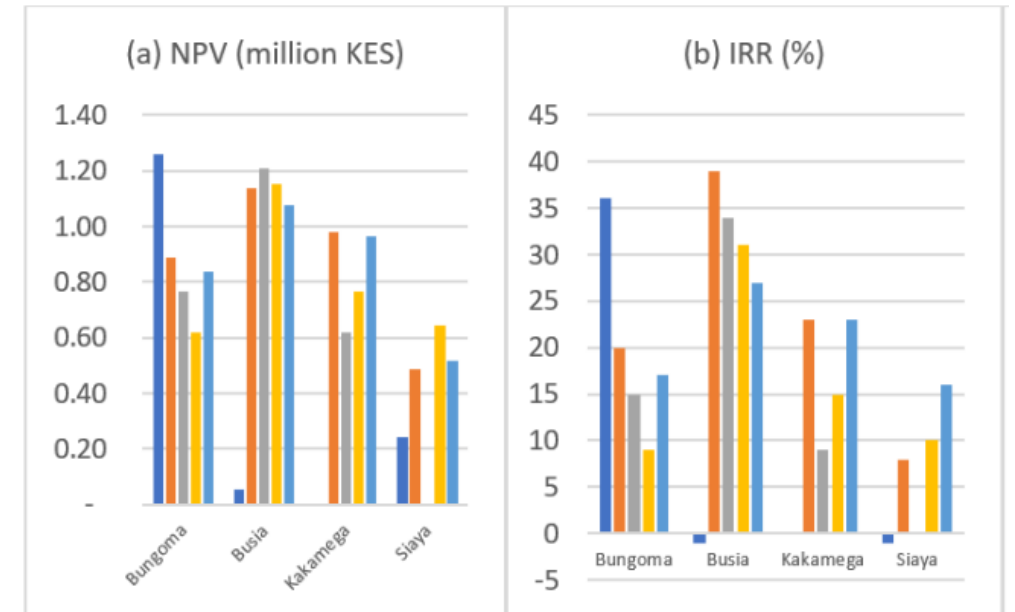
Filling the information gap on the economic significance and the environmental co-benefits

- **Western Kenya:** Busia, Kakamega, Bungoma, Siaya.
- **162 farmers testing** *Megathyrsus maximus* cv. Mombasa, Tanzania; *Urochloa* hybrid cv. Mulato II, Cayman; *Brachiaria brizantha* cv. Xaraes.
- **Data collection:** 1 year, 2 growing seasons. management practices, labour costs, fertilizer costs, manure costs, forage and hay sales, literatura.
- Economic evaluation
- Environmental assessment



Economic analysis

- Discounted free cash model
 - 12% discount rate
 - benefits from sales of hay and fresh forage (t/ha/y)
 - costs of forage establishment and maintenance.
- Annual benefits flows for the sales of
 - Fresh forage: 200 KES / bunch
 - Hay: 350 KES / 12 kg bale
- Estimation of profitability
 - Net Present Value (NPV)
 - Internal Rate of Return (IRR)
 - Return on Investment (ROI)



Environmental analysis

Environmental ex-ante assessment tool - "CLEANED" (<https://alliancebioversityciat.org/tools-innovations/cleaned>)

- inputs: agro-ecology, feed basket, feed management
- outputs: changes in land requirement, water use and greenhouse gas emissions

baseline wet season basket:

- 62% local natural grass,
- 5% Napier grass,
- 7% bean haulms,
- 10% maize stover,
- 5% sweet potato vines
- 11% Leucaena.

baseline dry season basket:

- 10% local natural grass,
- 60% Napier grass,
- 6% bean straw,
- 13% maize stover a
- 11% Leucaena.

Scenario:

- replacement of 50% Napier grass with Cayman
- resulting in 15% increase of milk yield (from 1600 to 1840 l/yr)

	Baseline	Cayman	Difference
Land requirement			
Total land required (ha/MT FPCM)	0.23	0.21	-9%
GHG emissions			
kg CO ₂ eq. /kg FPCM	1.40	1.32	-6%
Water impact			
m ³ /kg FPCM	0.47	0.40	-16%

Conclusion

- Cultivating improved forages and using them to optimize dairy cows' feeding strategies
 - More efficient use of farmers' land and water
 - Positive returns on the investments
- Can act as a good climate change mitigation option

This information is useful for farmers as well as local private and local development partners when looking for solutions for the feed scarcity they commonly face.



PRODUCTIVITY & ENVIRONMENTAL CO-BENEFITS of Tropical Forage Technologies

BENEFITS:

ENVIRONMENTAL GAINS

Improved Soil Quality
 Soil erosion reduced by half ↓50%
 Soil organic carbon increased by 10% ↑10%
 Better soil health (higher & more diverse microbial populations & activity) → increase resilience to drought, disease and pests.
 Increased nutrient cycling via manure high in nutrients, used as fertilizer
 Improved soil structure (higher aggregate stability and better aeration)
 Better water retention

Climate Benefits
 Reduced enteric fermentation from cows → reduced methane
 CH₄ ↓

Biodiversity Improved
 Less pressure to deforest, to accommodate livestock and crops.
 Regenerate degraded land
 More diverse farming systems

Reduced Water Use
 Improved tropical forages do not require a lot of water

LIVELIHOOD GAINS

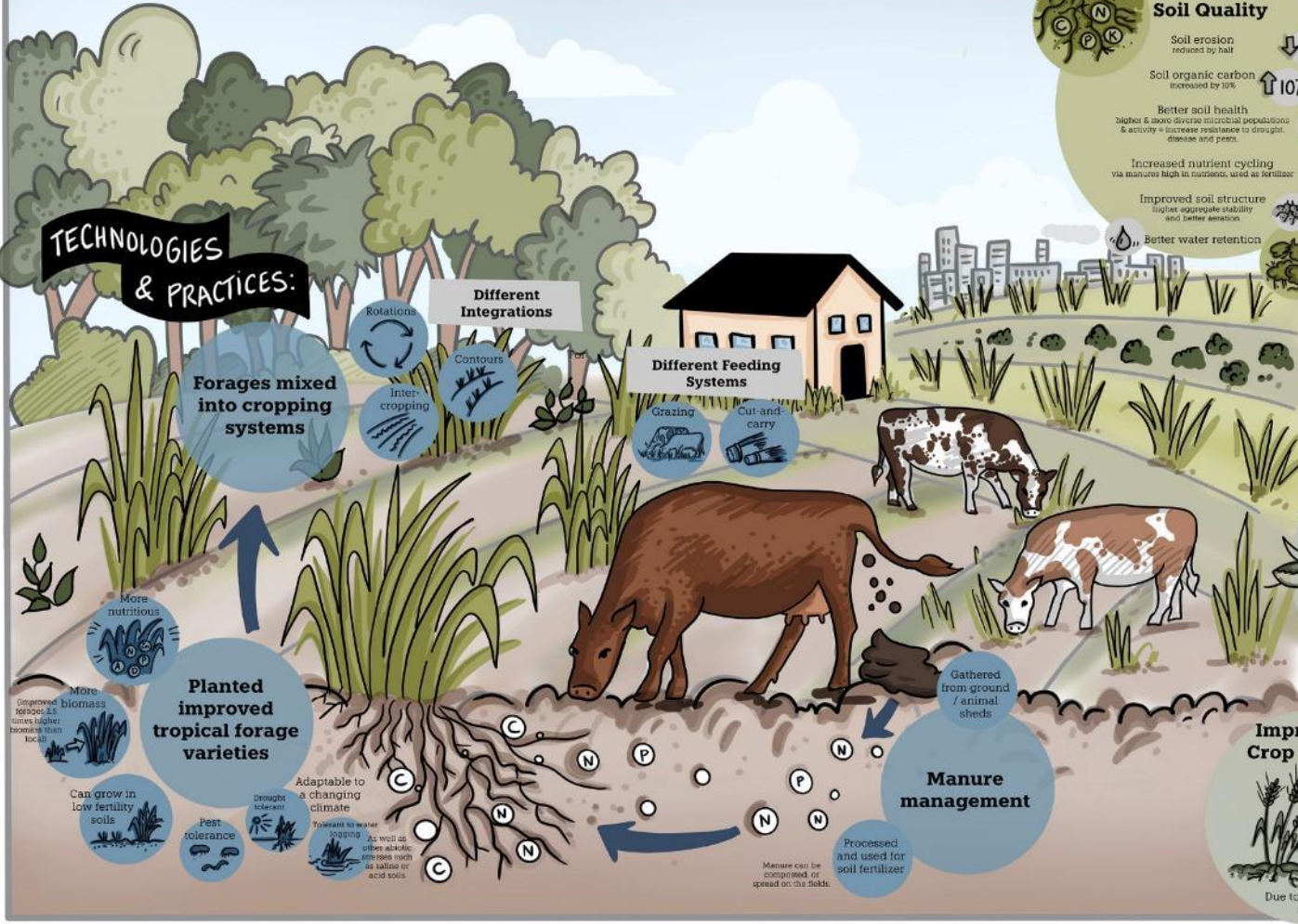
Healthier More Productive Animals
 Improved forages can increase milk yields by up to 39%

More income & income diversification
 New business opportunities

Improved Crop Yields
 Grain yields increase by 60% ↑
 Due to improved soils

Better Nutrition
 Better access to quality animal source foods

TECHNOLOGIES & PRACTICES:



KEY: TECHNOLOGIES / SOLUTIONS / PRACTICES | ENVIRONMENTAL GAINS / BENEFITS | LIVELIHOOD GAINS / BENEFITS



Grasses
 Most used/ commercialized
 > 150 Mil ha worldwide



Legumes
 High protein content
 Biological Nitrogen Fixation



Shrubs and trees
 Also mainly legumes
 Often high drought tolerance
 Slow establishment
 Long-term persistence



Thanks!



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