Low emissions investment options for the dairy sector: the case of improved fodder production

Polly Ericksen, ILRI

John Kashangaki, SBA Africa Ltd

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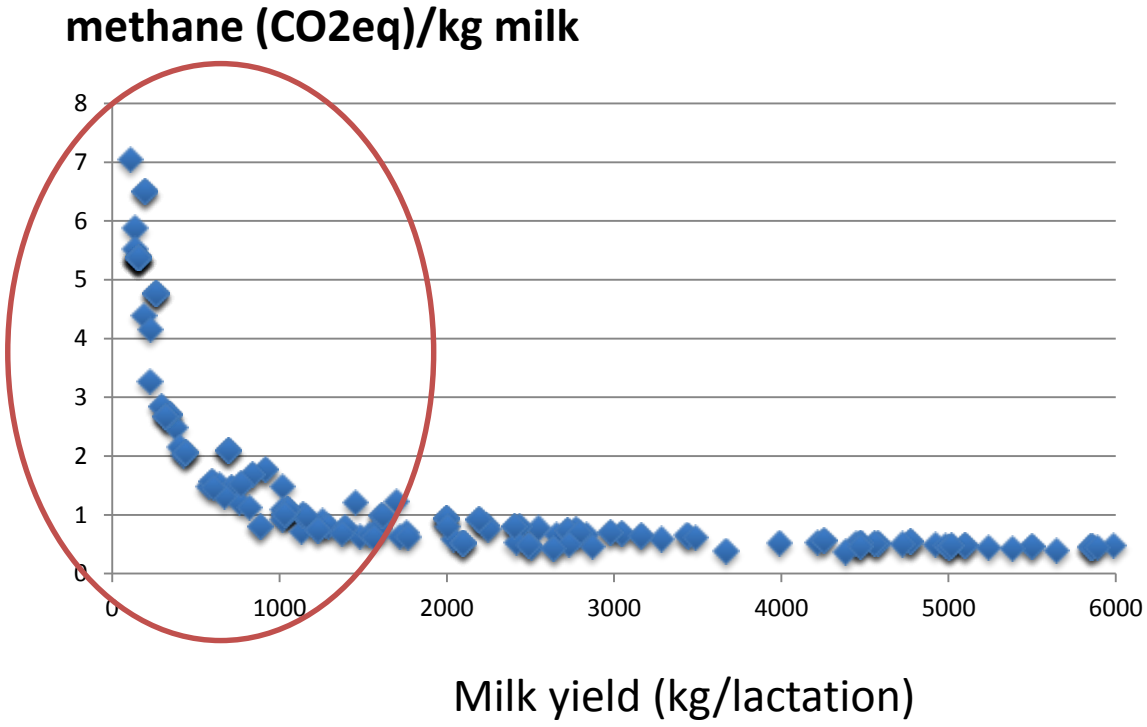
Exploiting yield gaps is key to achieve environmental benefits in ruminant systems

Gerber et al, FAO 2013



Largest improvements in low producing animals

Why Dairy? Why Fodder production?

- Kenya's dairy sector one of the largest in SSA, contributing 8% of GDP
    - Semi intensive/ intensive = 65% total emissions
- It is the fastest growing agricultural sub-sector, with increased investment in processing and marketing
- Adequate feed availability and quality is a pre-requisite for any other improvements

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Current feeding practices and gaps

- Natural grazing complemented with planted fodder, crop residues, limited use of concentrates
    - Intensive systems are largely stall feeding
- Seasonal fluctuations and shortages in the dry season
- Optimal feeding regime is 75% energy, 24% protein

Feasibility of improved forages

- Barriers
  - Low availability of land
  - Diversified cropping strategies
  - Low accessibility of improved planting material
- Potential incentives
  - Field trials to improve farmer awareness
  - Investments to stimulate fodder seed
  - Financial evaluation of specialization vs diversification

Ericksen and Crane 2018

Other constraints to bear in mind

- Degree of market orientation is often seen as a major precondition for upgrading
    - But informal market holds opportunities for women
- Even with market orientation, low milk prices inhibit investment in upgrading
- Low trust and accountability of input services

Ericksen and Crane 2018

Business Case: Farm level results

- Five counties from the central and Rift valley regions
    - Murang'a, Kiambu, Nyandarua, Nyeri and Uasin Gishu
- Vary by average land size, milk production, available feeds
- 3 cases: current practice, growing fodder, growing a different crop/ purchasing fodder

Results for Murang'a County

Case A. "As is" current land use, purchasing fodder: two Friesian cows (*rates monthly equivalent)

Item	Particulars (*rates are monthly equivalent)	Best case		Worst case	
		KES	%	KES	%
A. Revenues	Milk sales (24L best, 16L worst)	25200	93%	15840	90%
	Calf sale (2)*	1335	5%	1335	8%
	Manure*	500	2%	500	3%
	Total revenue	**27035**		**17675**	
B. Costs	Dairy meal—2 sacks (70kg)	2600	10%	2600	10%
	Salt lick	800	3%	800	3%
	Hay (KES250/bale *60 bales)	15000	60%	18000	72%
	Labour	6000	24%	6000	24%
	Water	500	2%	500	2%
	Pesticide*	50	0%	50	0%
	AI services*	125	0%	125	0%
	Total expenditure	**25075**		**28075**	
Gross margin (A–B)		**1,960**		**-10,400**	

Best price = KES35, worst price = KES33, best case hay costs KES250, worst case hay costs KES300

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Results for Murang'a County

Case B. Growing fodder on one acre: two Friesian cows (*rates monthly equivalent)

Item	Particulars	Best case		Worst case	
		KES	%	KES	%
A. Revenues	Milk sales (35L best, 20L worst)	37800	82%	19800	72%
	Calf sale (2)*	1667	4%	1667	6%
	Manure*	0	0%	0	0%
	Sale of hay (30 bales surplus)	6900	15%	6000	22%
	Total revenue	**46,367**		**27,467**	
B. Costs	Dairy meal—1.5 sacks (70kg)	3500	27%	2000	16%
	Salt lick	800	6%	800	6%
	Hay production/storage (70 bales)	1000	8%	1000	8%
	Labour	6000	47%	6000	47%
	Water	500	4%	500	4%
	Pesticide*	50	0%	50	0%
	AI services*	125	1%	125	1%
	Opportunity cost of one acre land	833	7%	833	7%
	Total expenditure	**12,808**		**11,308**	
Gross margin (A–B)		**33,558**		**16,158**	

Best price = KES35, worst price = KES33, best case hay costs KES230, worst case hay costs KES200

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Results for Murang'a County

Case C. Growing another crop, purchasing fodder: two Friesian cows (*rates monthly equivalent)

Item	Particulars	Best case		Worst case	
		KES	%	KES	%
A. Revenues	Milk sales (24L best, 16L worst)	25200	54	15840	57
	Calf sale (2)*	1335	3	1335	5
	Manure*	500	1	500	2
	Sale of food/cash crop	24000	42	10000	36
	Total revenue	**47,035**		**27,675**	
B. Costs	Dairy meal—2 sacks (70kg)	2600	8	2000	10
	Salt lick	800	3	800	4
	Hay (@ KES250/bale *60 bales)	15000	48	5000	24
	Labour	6000	19	6000	29
	Water	500	2	500	2
	Pesticide*	50	0	50	0
	AI services*	125	0	125	0
	Land field costs (paddock management)	6000	20	6000	29
	Total expenditure	**31,075**		**20,475**	
Gross margin (A–B)		**15,960**		**7,200**	

Best price = KES35, worst price = KES33, best case hay costs KES230, worst case hay costs KES200

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Gross Margins for the other four counties

County	Case A	Case B	Case C
Kiambu Best	13,417	63,800	30,000
Kiambu Worst	6,513	53,267	15,638
Nyandarua Best	6,067	23,158	17,900
Nyandarua Worst	2,683	7,625	10,684
Nyeri Best	6,337	23,883	21,420
Nyeri Worst	3,433	16,383	5,684
Uasin Gishu Best	5,675	22,223	20,175
Uasin Gishu Worst	625	9,043	10,125

Summary of findings: change milk yield and monthly profit margin

County	Milk production per cow (kg/litres) with fodder		Change in daily milk yield	Profit margins with fodder intervention (KES)		Change in monthly profit margins
	Worst case	Best case		Worst case	Best case	
Murang'a	7	20	186%	16,158	33,558	108%
Nyeri	6	15	150%	16,383	23,883	46%
Uasin Gishu	6	15	150%	9,043	22,223	146%
Kiambu	12	22	83%	53,267	63,800	20%
Nyandarua	5	13	160%	7,625	23,158	204%
Average	**7.2**	**17**	**146%**	**20,495**	**33,325**	**105%**

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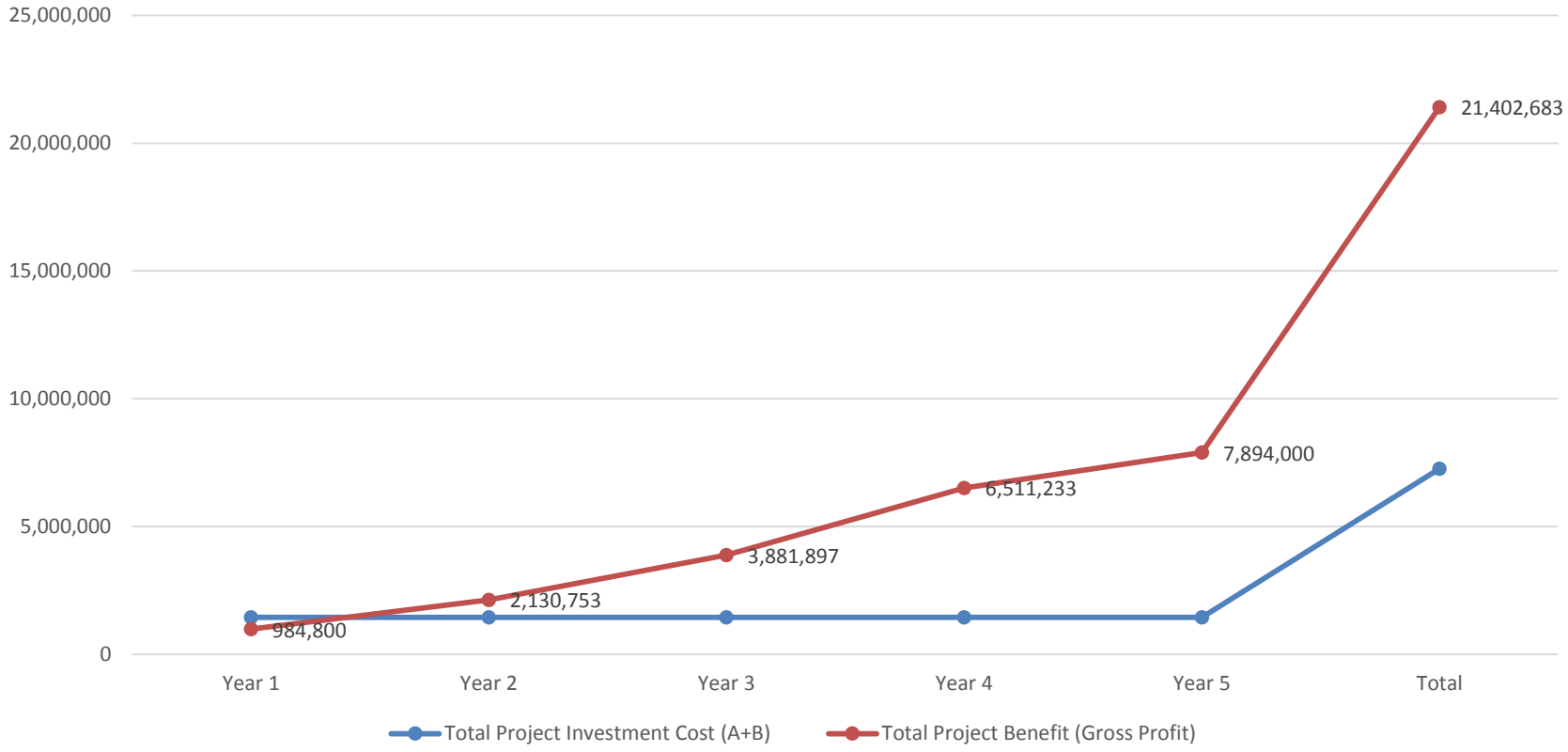
Fodder production can generate greater revenue and reduce emissions

- Both milk yields and profit margins improve
- GHG emissions intensities can reduce
  - 8 to 24% (FAO and NZAGGRC) or up to 0.46 metric tons CO_2 equivalent with conservative adoption rates.
  - A different scenario (Brandt et al) suggests reductions up to 26-31%, if combine forages with concentrates

Fodder project costs versus benefits over for five years



Other value chain actors can offer crucial support

- Cooperatives important for formal milk marketing.
  - Networks can be used to share information
  - Can stimulate fodder markets with bulk purchases
  - Can also stimulate other input markets
  - ?? Ability to improve or stabilize milk prices
- Processors
  - ?? Milk prices
  - Information

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Project proposal

- Target 30,000 farmers across 3 counties
- Outcome: 50% increase milk production and 100% increase in fodder production
- Estimate 10% reduction in GHG emissions intensities per animal
- Outputs: training and extension materials; model farms
- Cost 1.1 M USD per county

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Conclusions

- Cost-benefit analysis suggest improved fodder production could be profitable in intensive systems
    - Opportunity cost of land is key
    - Also risk of fluctuating milk prices
- Currently lack information and market support
- Potential emissions reductions intensities of at least 10%
- Project investment would see a positive return in 3 years

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Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
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ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

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