CLIMATE-SMART Agriculture 2015

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Impact of feeding strategies on GHG emissions, income over feed cost and economic efficiency on milk production

Iñamagua-Uyaguari Juan Pablo[1], Jenet Andreas[1], Wattiaux Michel[3], Guerra Leonardo[1], Vilchez Sergio[1], Chacón-Cascante Adriana[1], Posada Karla[1], Barrantes Luz[2], Casasola Francisco[1], Villanueva Cristobal[1], Leon Hector[4], Lapidus Daniel[5]

1 Centro Agronómico Tropical de Investigación y Enseñanza (CATIE),
2 Universidad de Costa Rica
3 University of Wisconsin-Madison, USA
4 Cooperativa Dos Pinos
5 US Department of Agriculture

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Context

- Costa Rica´s commitment to carbon neutrality by 2021
- Agricultural sector of Costa Rica represents 39% of CO_2eq national emissions
- CH_4 enteric fermentation represents 89% of the agricultural emissions in CR
- National Appropriate Mitigation Actions (NAMAs)
- How does feeding practice in the Costa Rican dairy sector influence emissions?

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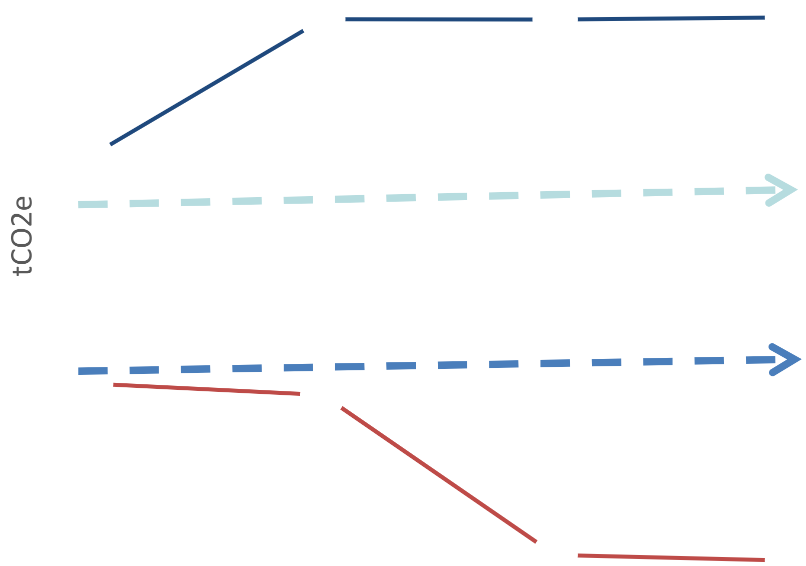
National Appropriate Mitigation Action (NAMA) Livestock in Costa Rica

Carbon offtake

Carbon balance

Emission reduction



NAMA Livestock: 12,93M $t.CO_2eq$ mitigation potential in the next 15 years

- Increased efficiency of N use
- Pasture rotation
- Silvopastoril systems
- Pasture improvement

Outline

- ❑ **Objective and description of the study**
- ❑ Feeding strategies in Costa Rica dairy sector
- ❑ Income over feed cost
- ❑ Partial GHG emissions from dairy operations
- ❑ Economic efficiency of milk production
- ❑ Climate smart livestock? How to achieve this in Costa Rican dairy sector
- ❑ Conclusions

Objectives of the study

- Analyse feeding strategies for cows in production in dairy farms in Costa Rica
- Determine effects of fertilization and feeding strategies on greenhouse gas emissions
- Determine income over feed cost and economic efficiency for milk production in CR

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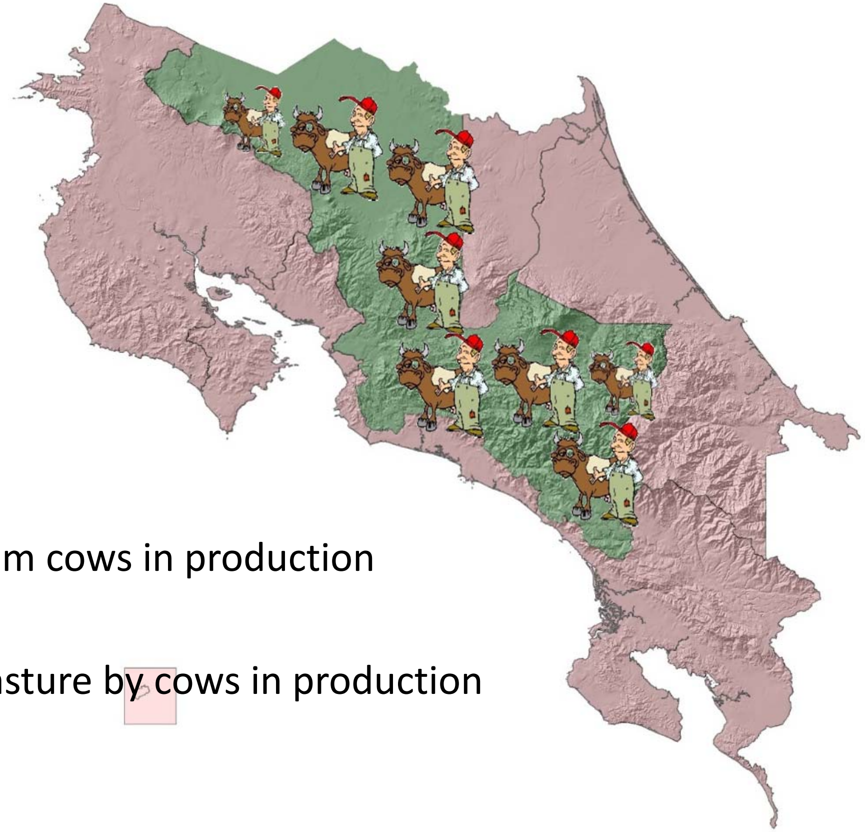
Description of the study

- Data sources:
  - Dos Pinos Cooperative database (costs)
  - Survey of 104 cooperative dairy farms
- Animal category:
  - Lactating cows only
- Variables collected:
  - Herd management
  - Feeding strategies
  - Nitrogen fertilizer application
- Calculated emission:
  - CH_4 emissions from enteric fermentation from cows in production
  - N_2O emissions from synthetic fertilizer
  - N_2O emissions from manure deposited in pasture by cows in production
- Equations used:
  - IPCC 2006



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Feeding strategies in the Costa Rica dairy sector (cluster analysis)

Variable	Cluster				P
	1	2	3	4	
Concentrate (%)	$22,9^{A}$	$26,2^{A}$	$26,3^{A}$	**$37,7^{B}$**	***
By-products (%)	$4,1^{A}$	$4,4^{A}$	**$46,0^{C}$**	$7,8^{B}$	***
Fodder grass (%)	$2,1^{A}$	$16,6^{B}$	$9,1^{B}$	$7,2^{A}$	***
Pasture consumption (%)	**$70,9^{D}$**	$52,8^{C}$	$18,7^{A}$	$47,1^{B}$	***
Grazing hours/day	20^{B}	$13,1^{A}$	$17,6^{B}$	$18,4^{B}$	***
Cut+carry forage area (ha)	$0,5^{A}$	**$3,6^{C}$**	$2,6^{BC}$	$1,2^{AB}$	***
Grazing area (ha)	19,8	24,6	16,5	14,8	NS

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Income over feed cost (IOFC)

Variable ($/cow/day)	Cluster 1	2	3	4	*P*
Total feeding costs	**2,45^{B}**	3,28^{B}	**4,68^{A}**	**4,44^{A}**	***
Income	7,44^{B}	8,33^{B}	8,29^{AB}	**9,80^{A}**	<0,1
IOFC	**4,99**	**5,05**	**3,62**	**5,36**	**ns**

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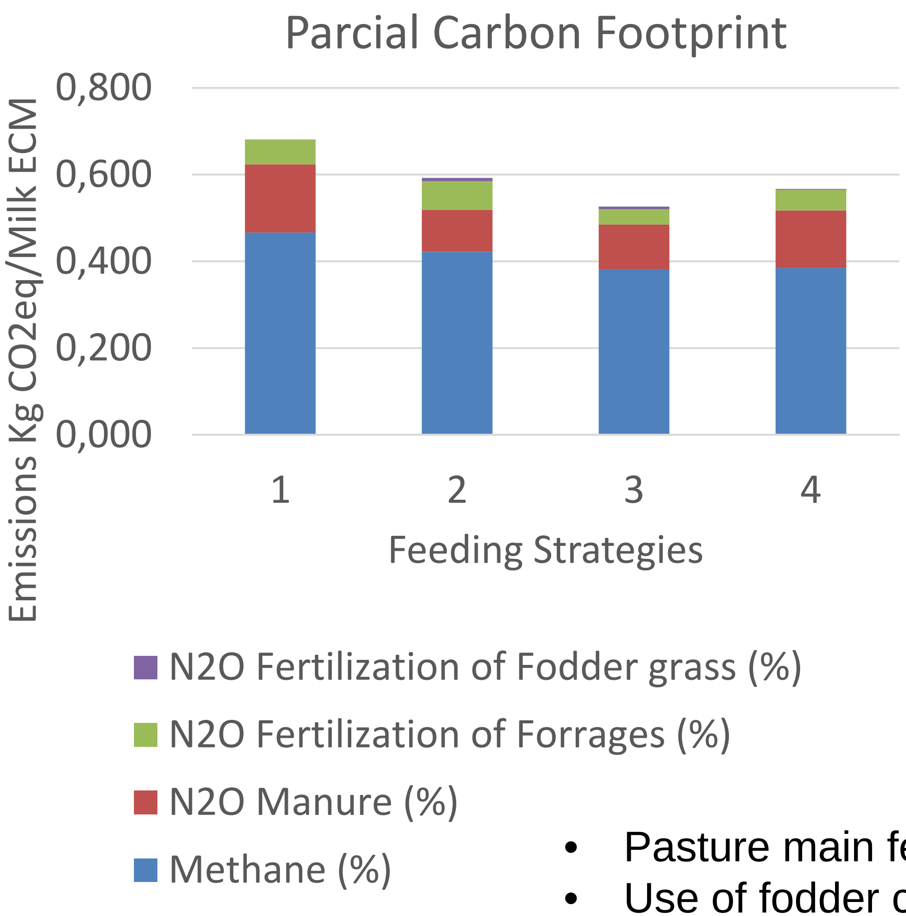
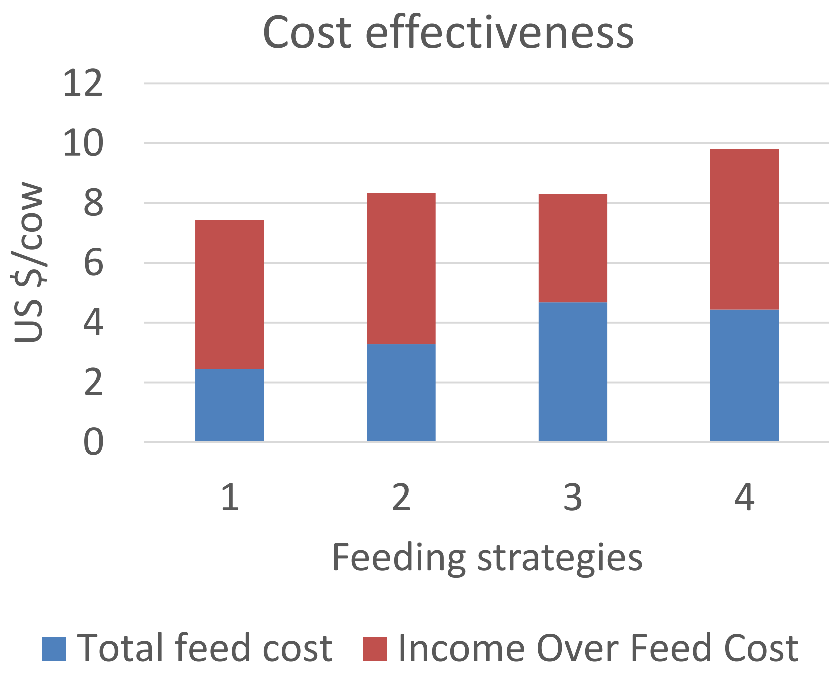
Partial GHG emissions from dairy operations





- Pasture main feed source; higher footprint
- Use of fodder crop reduces the footprint
- Farms with higher use of by-products tend to have low footprint
- External procurement feed results in high costs
- Cost effectiveness (Income Over Feed Cost) is n.s. between the groups

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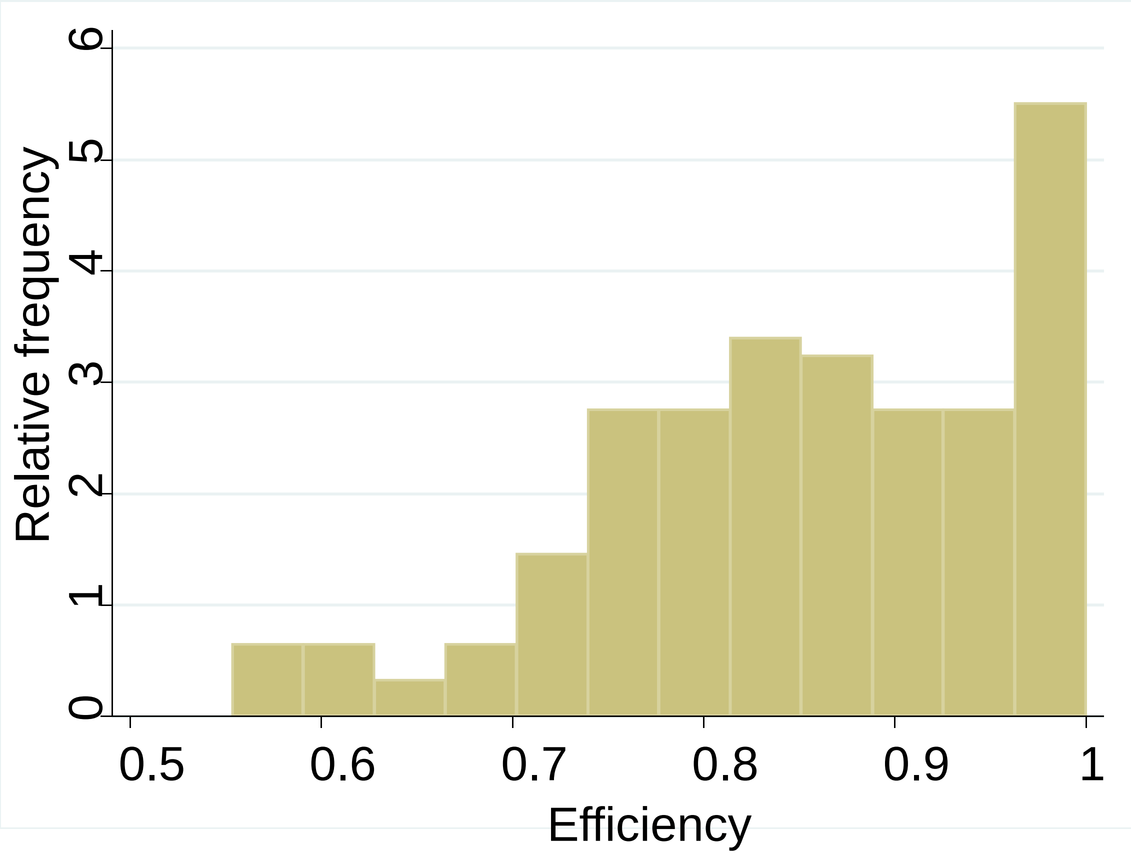
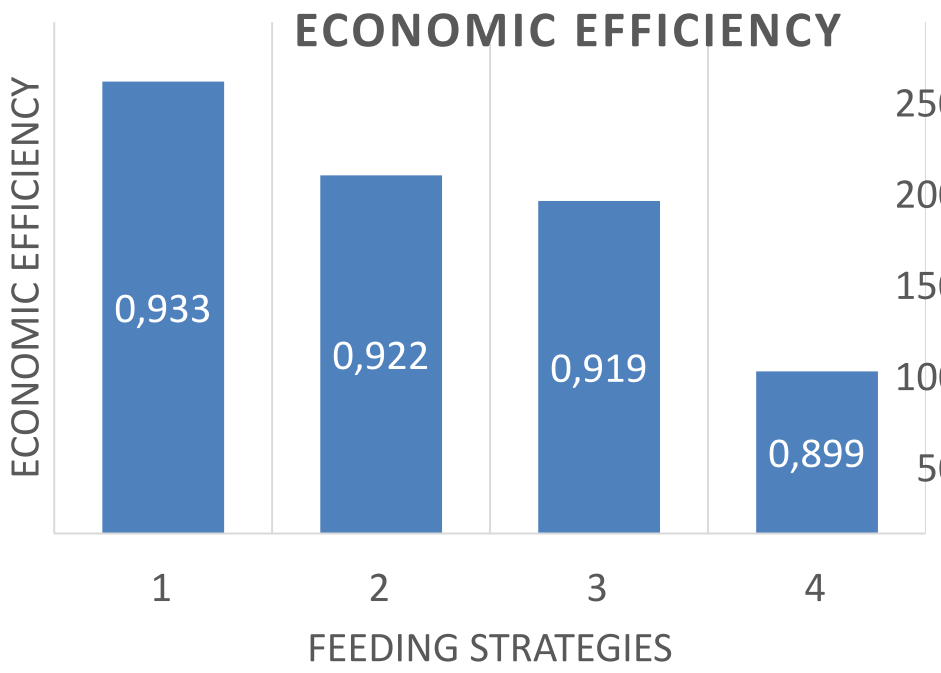
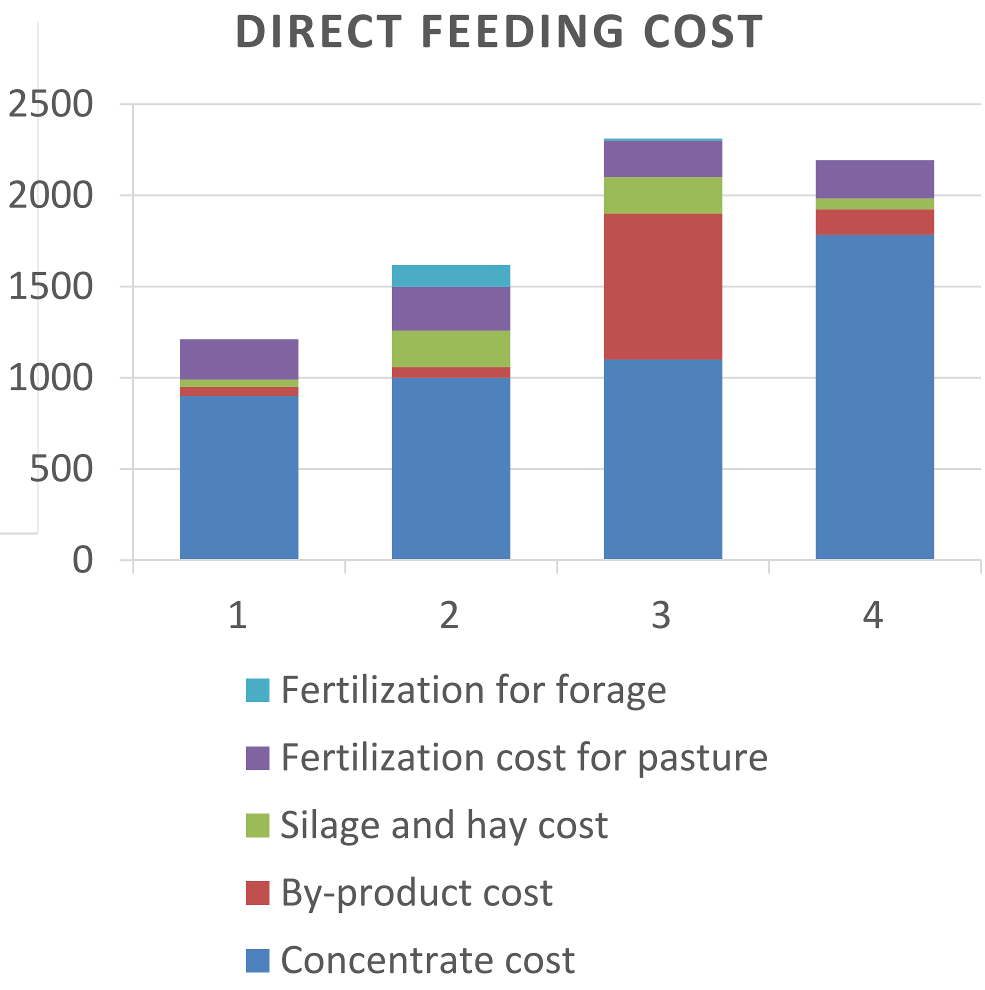
Economic efficiency of milk production

The more efficient farms are closer to 1.0
Results fall between 0.55 and 0.99, with an average of 0.85 (heterogenous distribution)
Access to financial services explained some of the variation



Economic efficiency was not achieved using higher concentrate feeding levels





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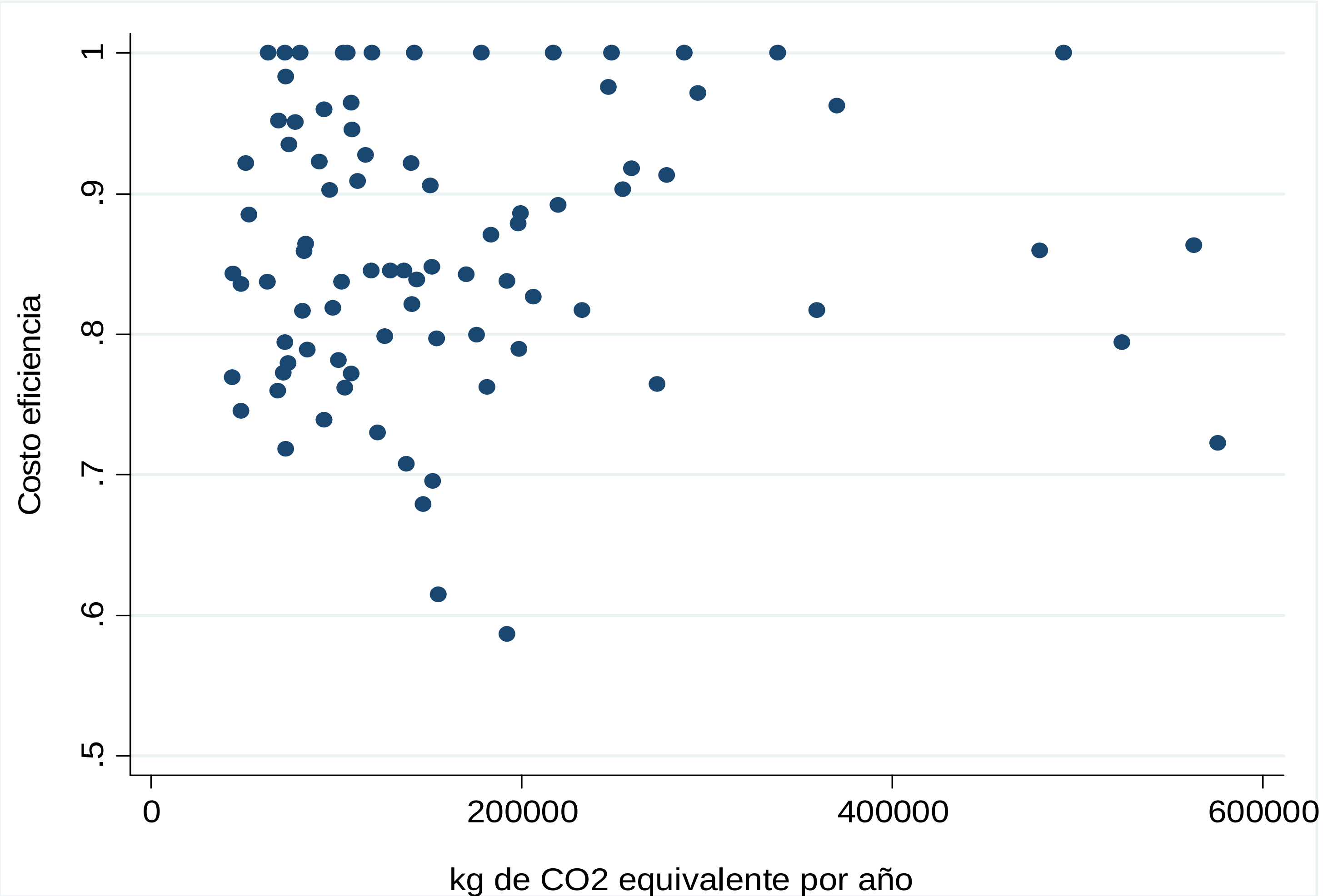
Economic efficiency did not correlate with carbon footprint



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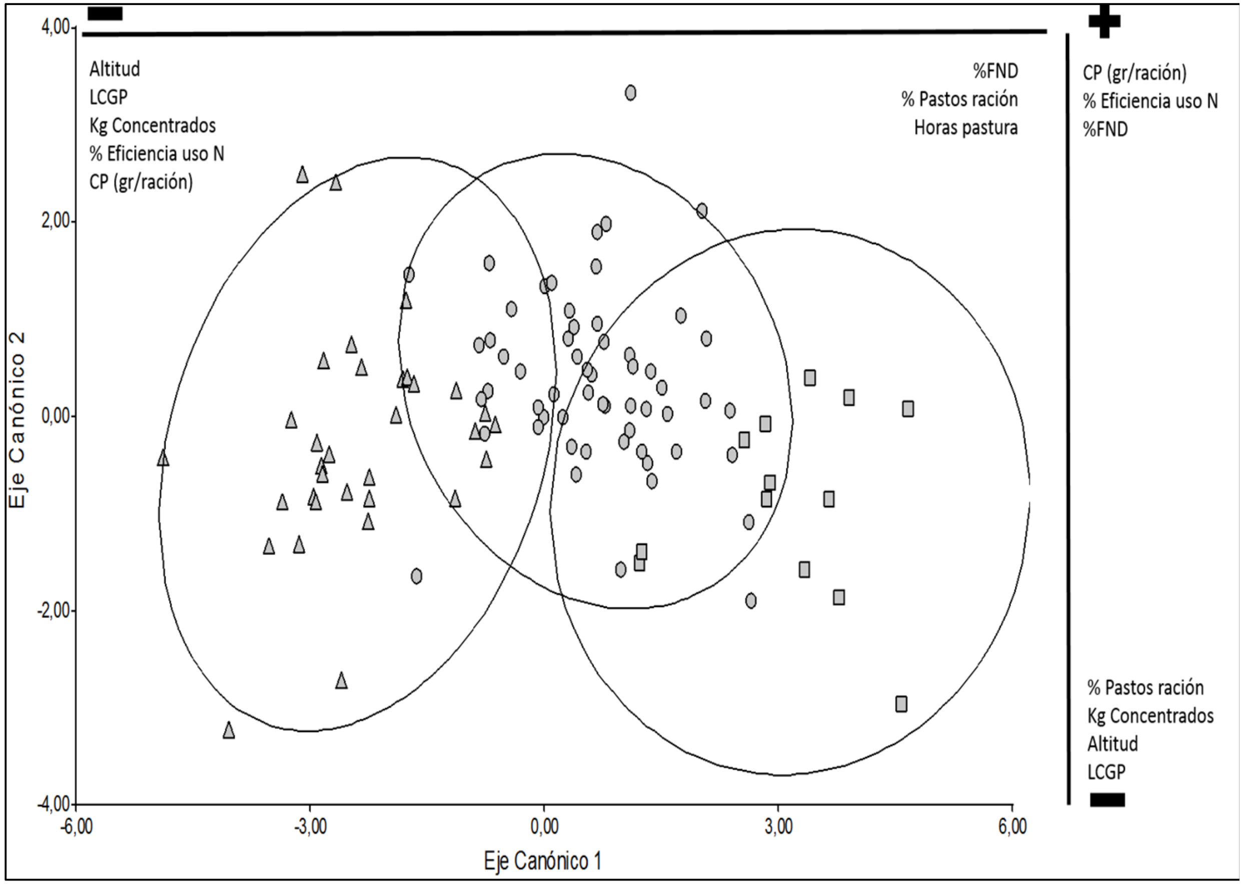
Climate smart livestock? How to achieve this in Costa Rican dairy sector

Variables that explain why a farm has a high (or low) carbon footprint:

1. Fiber content (NDF) (+)
2. Nitrogen efficiency (+/-)
3. Hours in the pasture (+)
4. Milk production (-)
5. Concentrate use (-)



Δ low emissions; ○ medium emissions ; □ higher emissions

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Conclusions

- Although CH_4 is the most important GHG, efforts to reduce emissions from fertilization of pastures could have an immediate impact.
- GHG emissions respond to complex dynamics (genetic factors, location and management); farms can categorized by their GHG profile.
- Improved feed management leads to less emissions, but this at a cost if inputs are external; → need smart on-farm solutions
- Higher economic efficiency did not lead to less emissions

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CLIMATE-SMART Agriculture 2015 CATIE Solutions for environment and development Soluciones para el ambiente y desarrollo USDA CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS