Towards a low emission development strategy in dairy farms in Costa Rica

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2. Technical efficiency in dairy production
3. Considerations for the design of a low emission development in the dairy sector

1. Feeding strategies and their relationships with costs and methane and nitrous oxide emissions

Overview

- **Research study description**
- Characterization of feeding strategies
- Methane and nitrous oxide emissions
- Direct cost of feeding and Income Over Feed Cost
- Conclusions

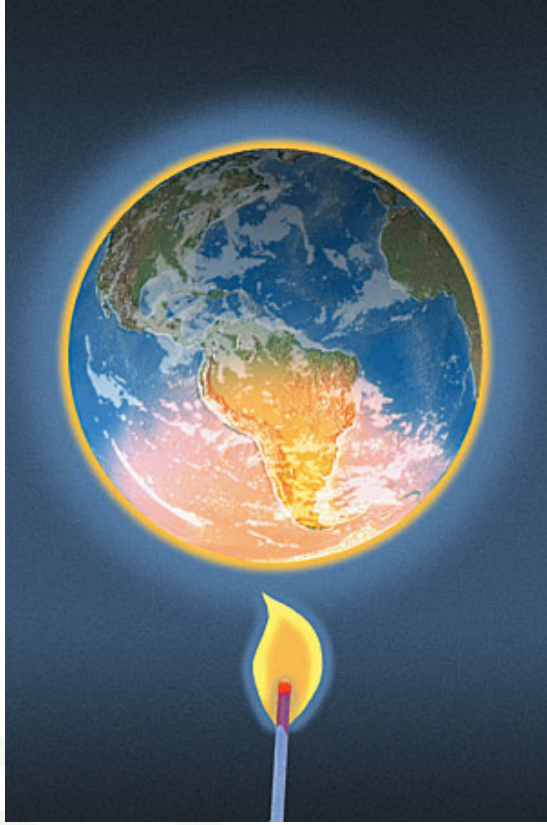
Objectives of the study

- Understand the management (feeding) strategies in the dairy farms of Dos Pinos
- Determine the relationship between strategies and methane and nitrous oxide emissions
- Determine the relationship between feeding costs and strategies

Greenhouse Gas Emissions

- CO_2 levels in the atmosphere increased by 40% compared to pre-industrial period (IPCC, 2013)
- Costa Rica emitted in 2005 8.8 Mt CO_2
- Costa Rican agricultural sector represents 39% of the total emissions (Chacón *et al* 2009)
- Enteric Methane represents 89% of the agricultural emissions in 2005 (88 kt) (Chacón *et al* 2009).

Global Warming: Scenarios for Costa Rica



- Precipitation:
  - Scenario B2: -8,43% for 2030; -10 a 13% for 2100
  - Scenario A2: -3,87% for 2030; -27 a 32% for 2100.

- Temperature:
  - Scenario B2: +0,83°C for 2030; +1,77°C for 2050
  - Scenario A2: +0,77°C for 2030; +1,60°C for 2050
- Direct Impact on Water availability
- Ecos sytems:
  - +1°C: 30% of species increased propability of extinction; increase of corals damages
  - +2°C: General destruction of corals
- Food Security:
  - +1°C decent in productivity for grain production in lowlands
- Coasts:
  - +2°C Millions of people increased confronted with floods (CEPAL y CCAD, 2010)

Materials y Methods

- Polulation
  - Dairy farms of Dos Pinos Cooperative
- Data collection
  - Database: Cost 2013 Dos Pinos, SICAL®
  - Survey of 104 Farms
- Variable description
  - Location (altitude, livelihood zone)
  - Climate (precipitation, temperature)
  - Herd (management categories, genetics, # animals)
  - Herd management (hours in the barn)
  - Feeding (quantity y type of feeding)
    - Diet characteristics
  - Fertilization (quantity, application period)

Materials y Methods

- DM consumption (kg/animal/day)
  - Additives, concentrates, forages, by-products, fodder grass
- Methane emissions (CH_4gr/animal/day)
  - Cows in production
  - IPCC 2006, NRC 2001, IDF 2010, Van Horn *et al* 1994
- Nitrous Oxide (N_2O kg/ha/year)
  - Fertilization of pastures, fodder grass
  - Manure in the pastures
- Feeding Costs (IOFC) (colones/day/animal)
- Income of milk sales (colones/day/animal)

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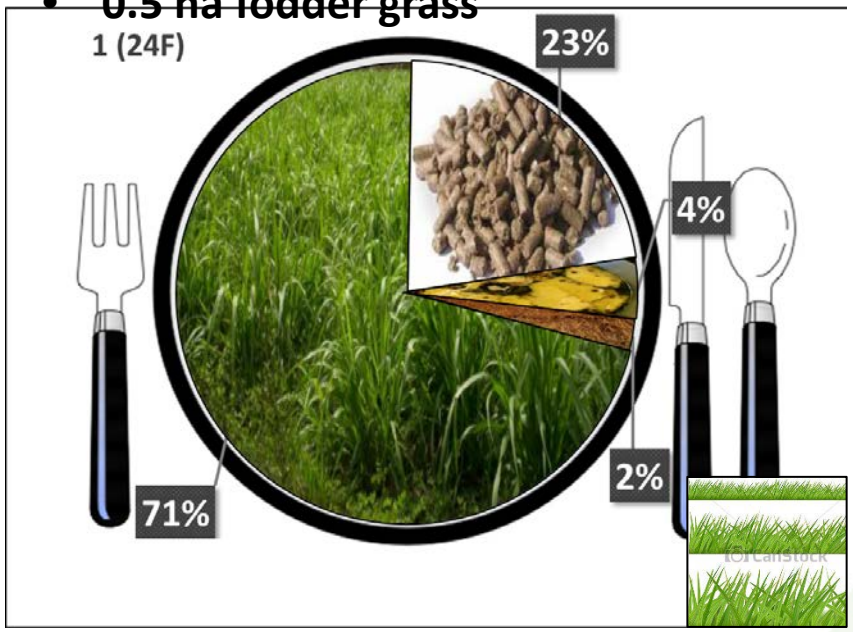
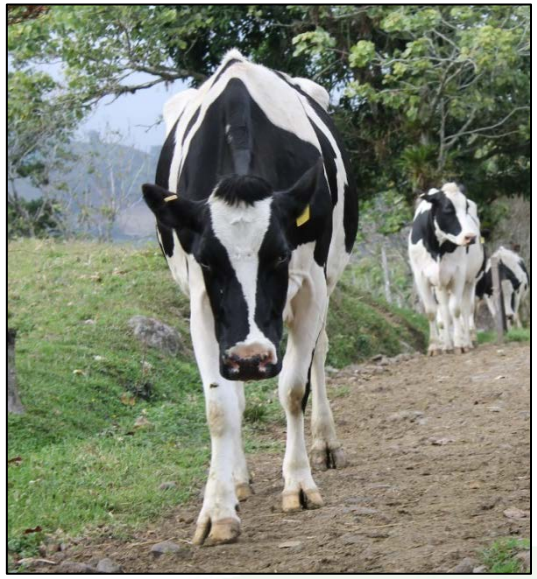
Feeding strategies

- **20 hours/day in paddocks**
- **19.8 ha paddocks**
- **0.5 ha fodder grass**



- CP: 12.3
- NDF: 54.2
- EE:2.6
- DMD: 70

- Altitude: 383msnm
- DMI: 15.2 kg/day
- Milk production (ECM): 12.7 kg/día



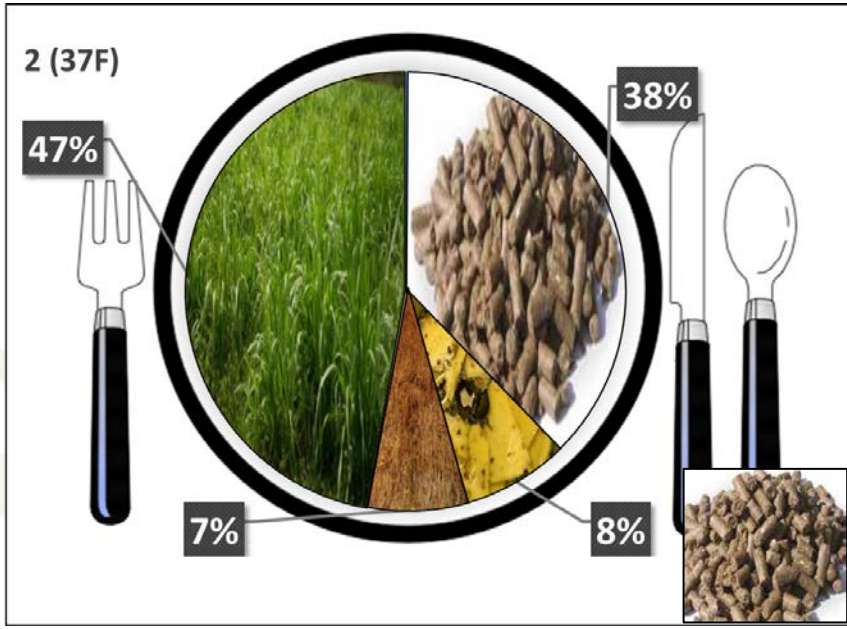
Pastures

Concentrates

Fodder grass

By-Products

- **15 hours/day in paddocks**
- **14.8 ha paddocks**
- **1.2 ha fodder grass**

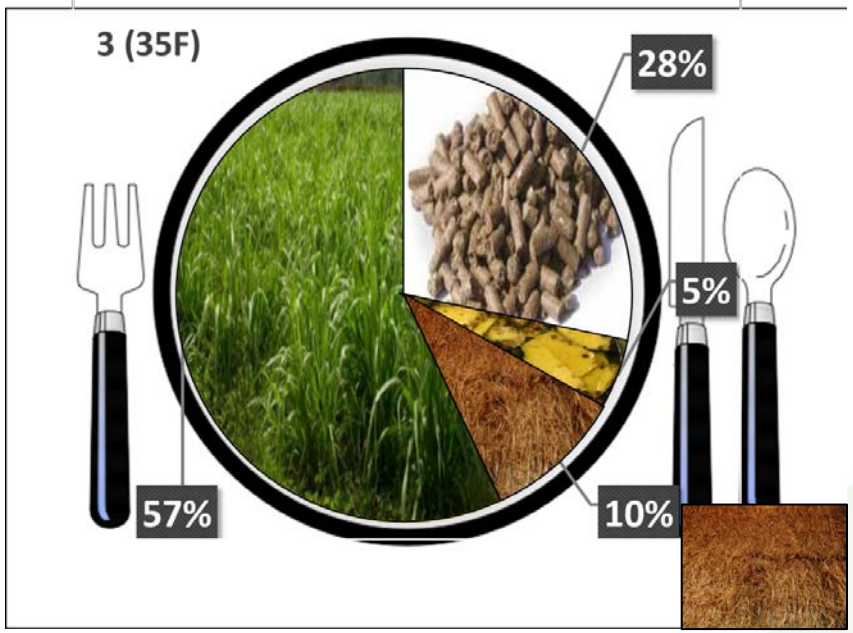


- CP: 13.5
- NDF: 42.1
- EE:2.7
- DMD: 73.3

- Altitude: 909msnm
- DMI: 17.1 kg/day
- Milk Production (ECM): 16.6 kg/day

ESTRATEGIAS DE ALIMENTACIÓN

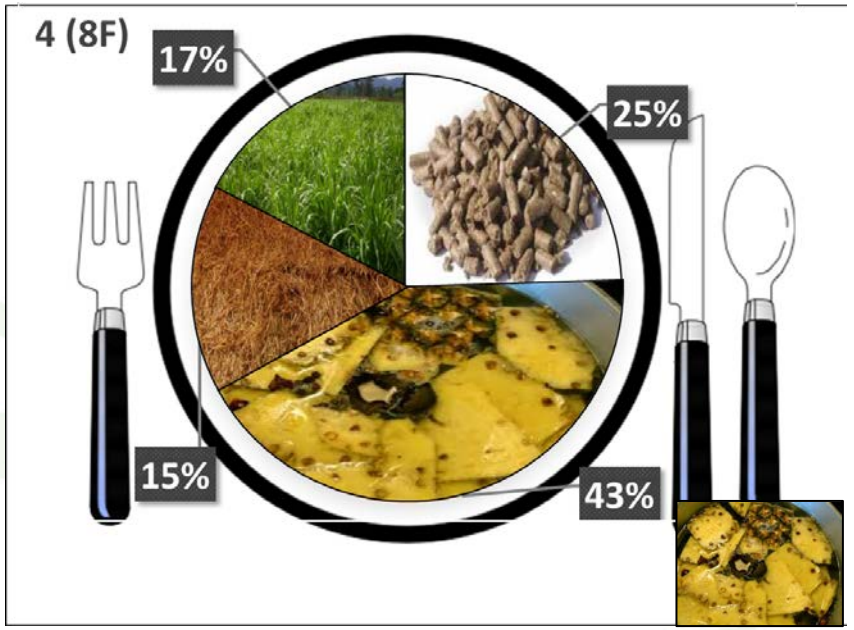
- **13 hours/day in paddocks**
- **24.6 ha paddocks**
- **3.6 ha fodder grass**



- CP: 12.9
- NDF: 52.3
- EE: 2.6
- DMD: 71.1

- Altitude: 746 m
- DMI: 15.4 kg/day
- Milk Production (ECM): 14.1 kg/day

- **17.6 hours/day in paddocks**
- **16.5 ha paddocks**
- **2.6 ha fodder grass**



- PC:10,5
- FDN: 23,7
- EE:2,4
- DMS: 75,7

- Altitude: 650 m
- DMI: 16.0 kg/day
- Milk Production (ECM): 14.1 kg/day

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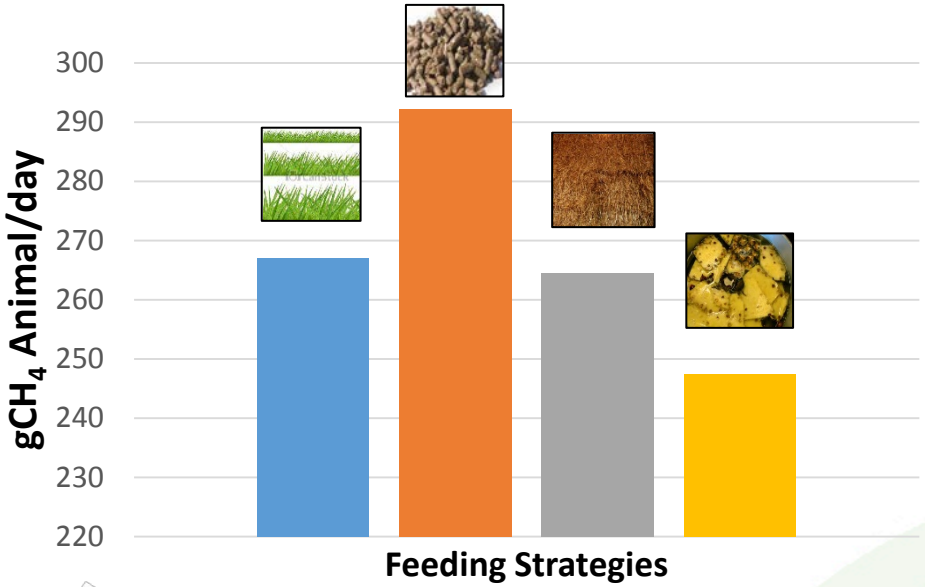
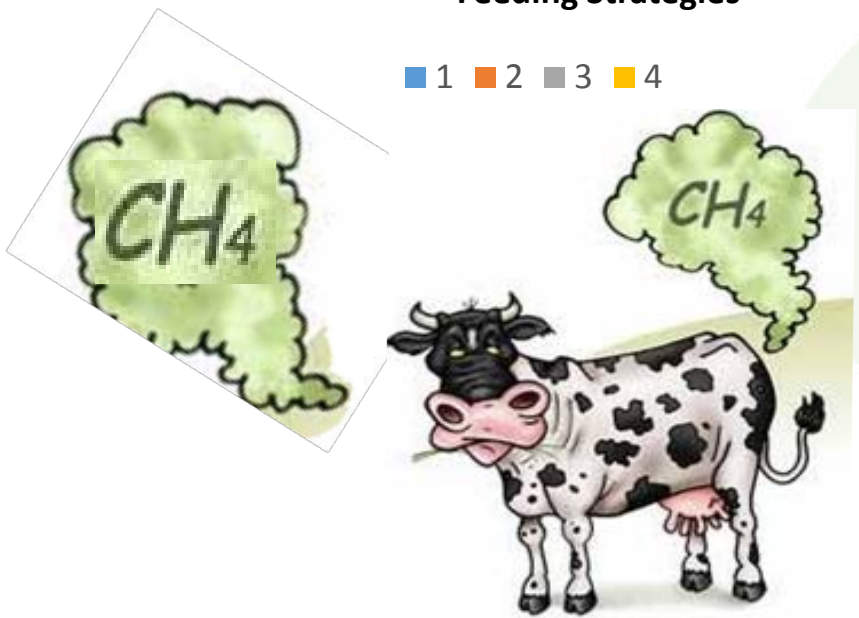
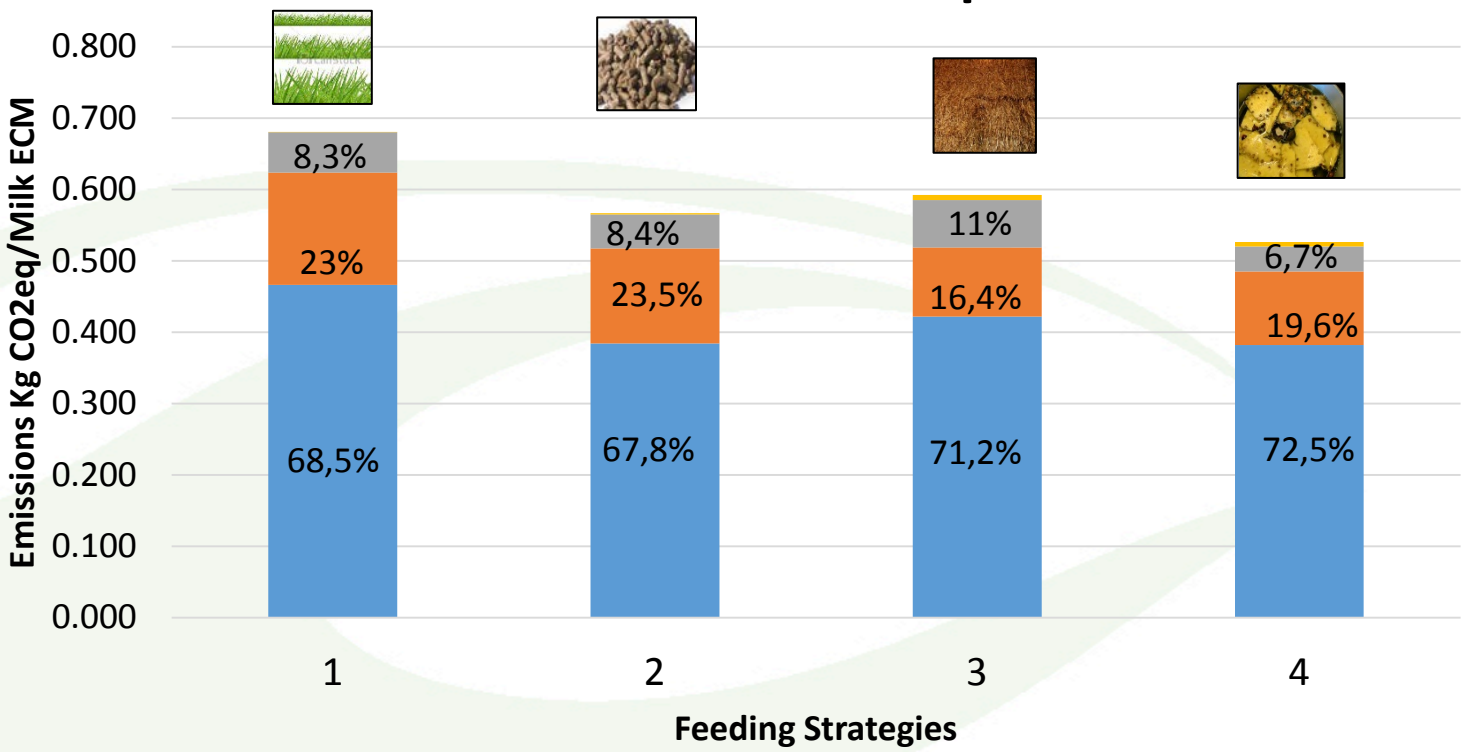
Methane Emissions





Parcial Carbon Footprint



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- ❑ Characterization of feeding strategies
- ❑ Methane and nitrous oxide emissions
- ❑ **Direct cost of feeding and Income Over Feed Cost**
- ❑ Conclusions

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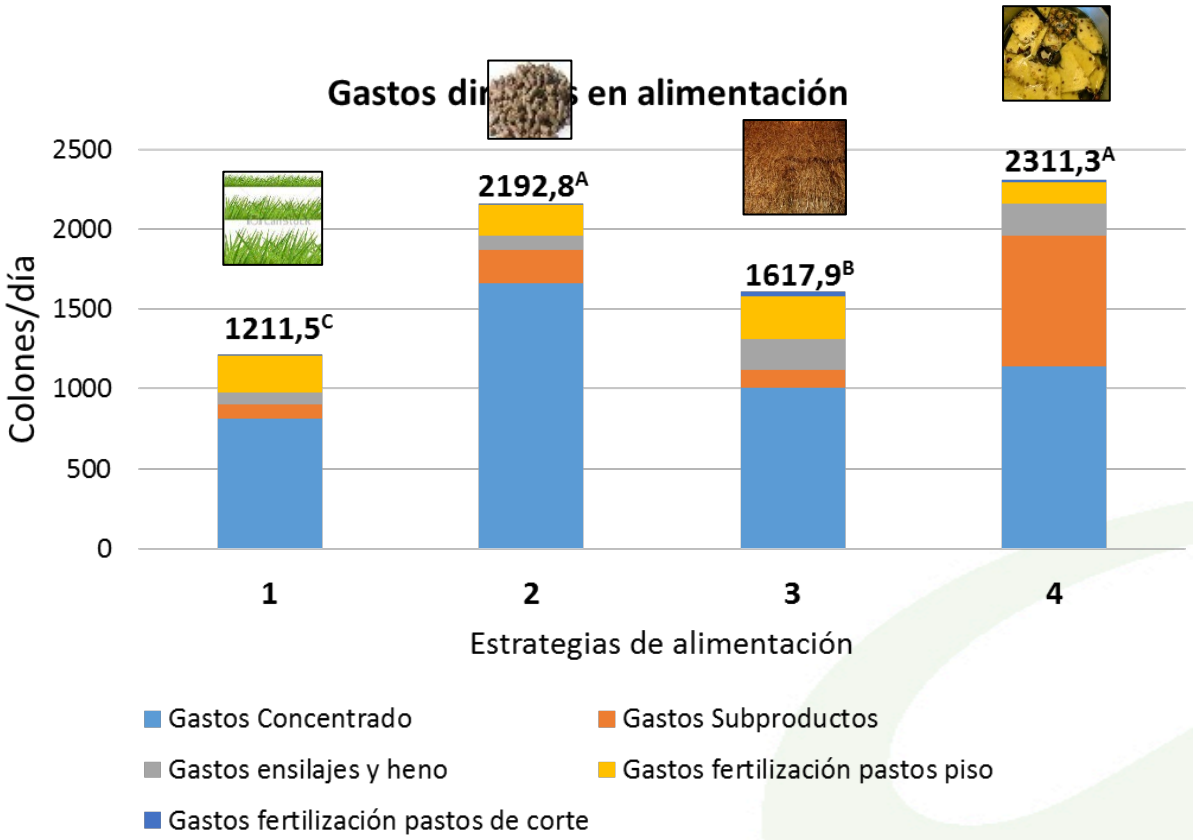
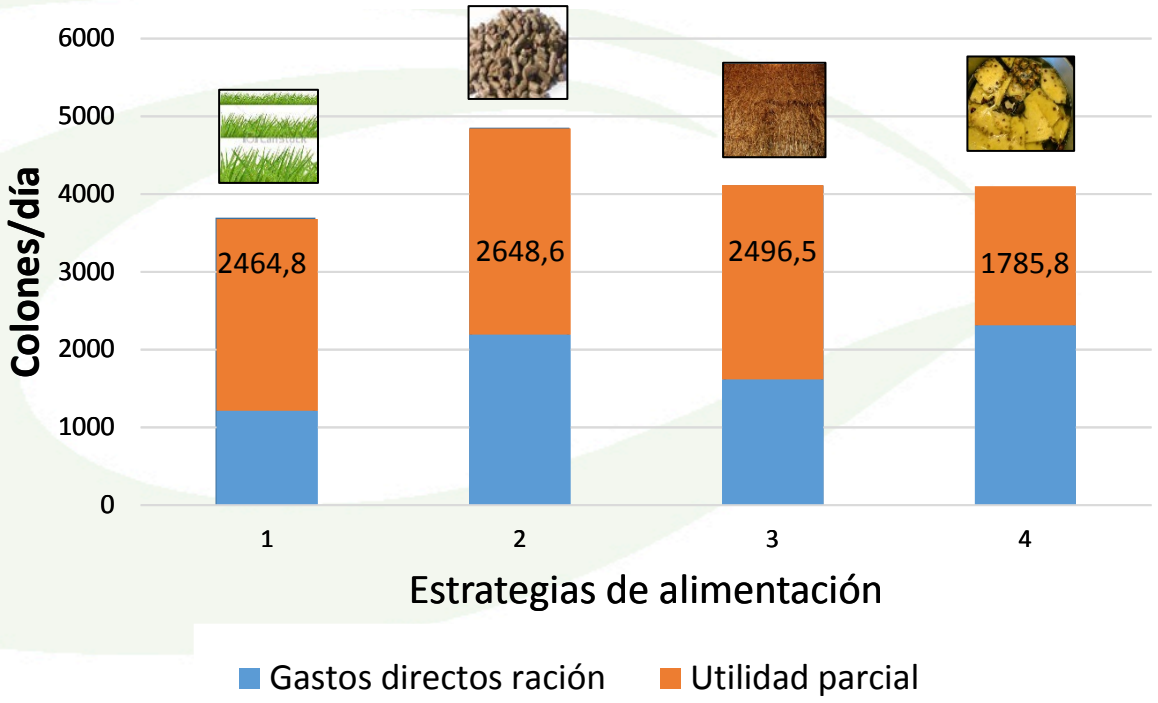


Income over Feed Cost



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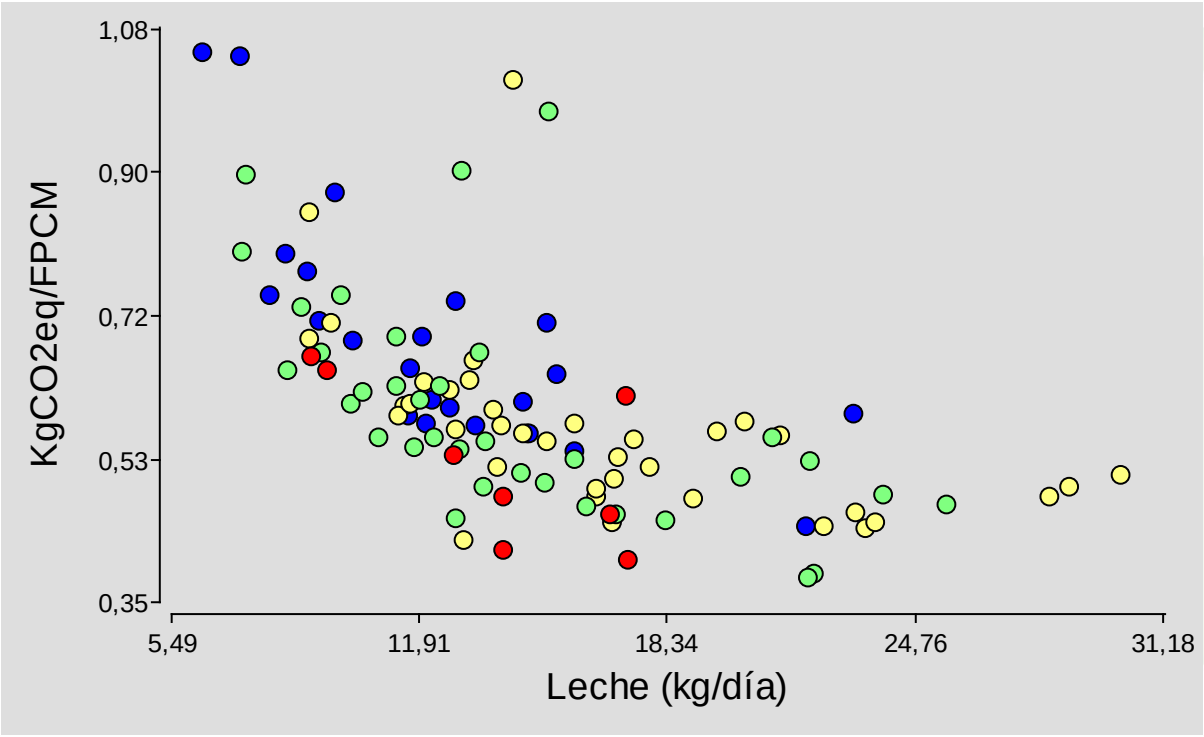
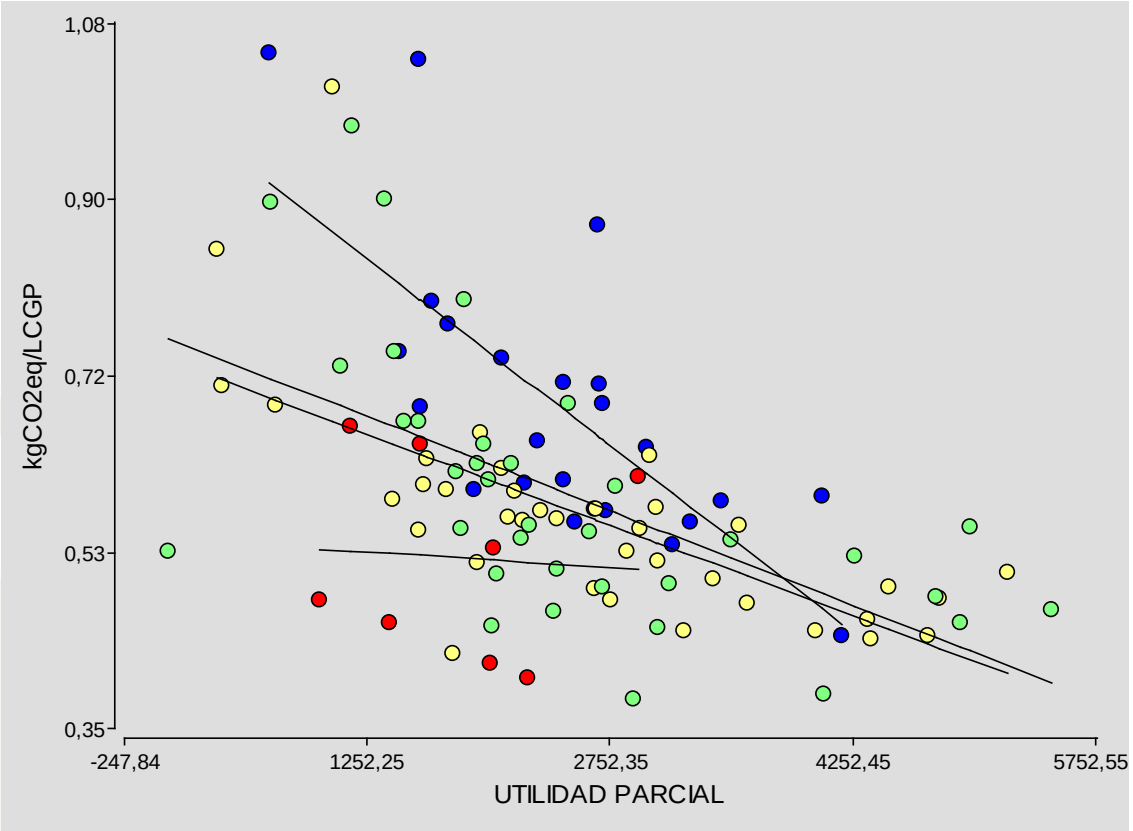
CONCLUSIONES

Milk production is determining the partial carbon footprint





Farms with higher Income Over Feed Cost are representing a smaller partial carbon footprint

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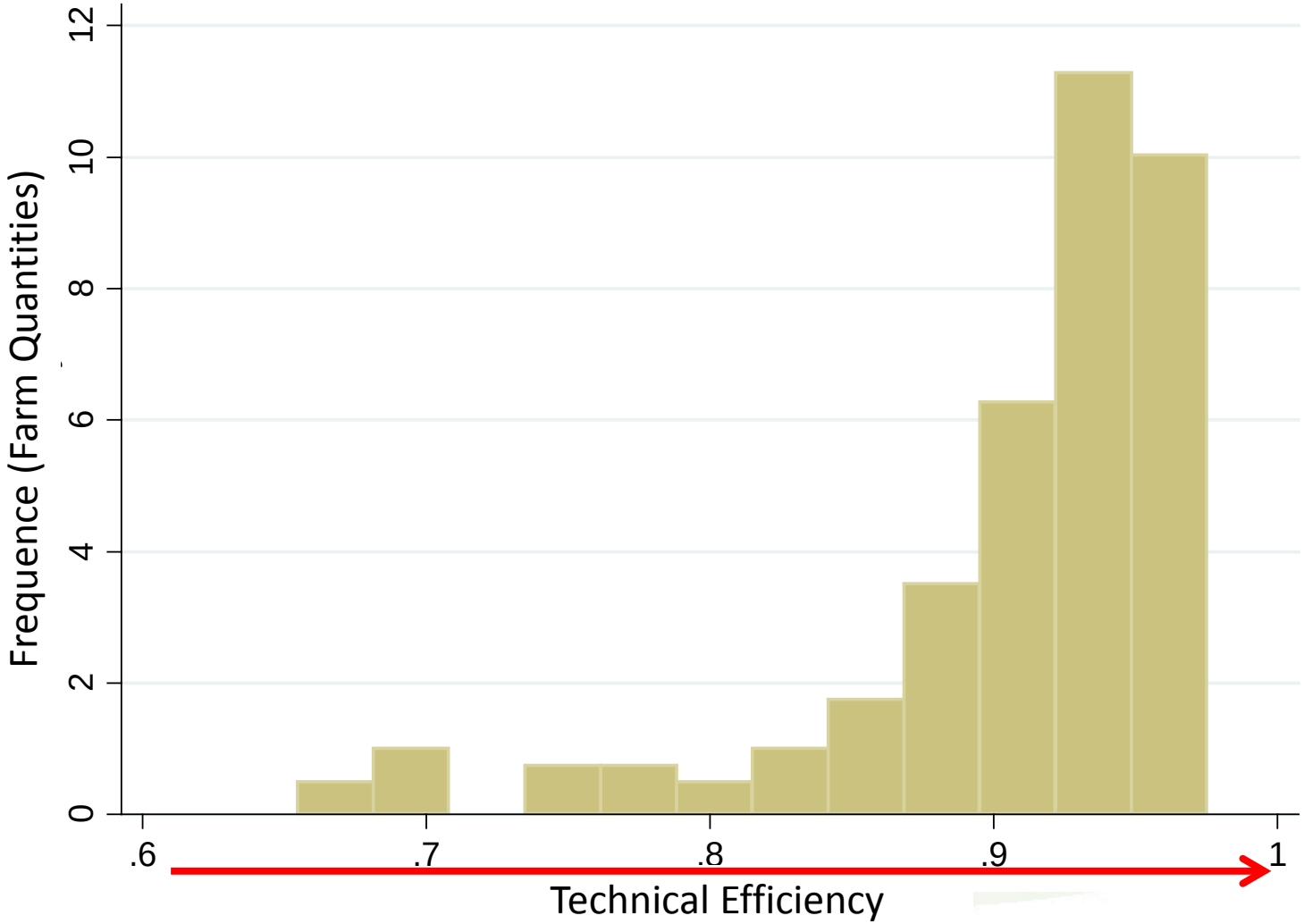
Technical Efficiency of Milk Production

Technical Efficiency of milk production in Dos Pinos farms

Based on the 149 dairy farms Costos 2013



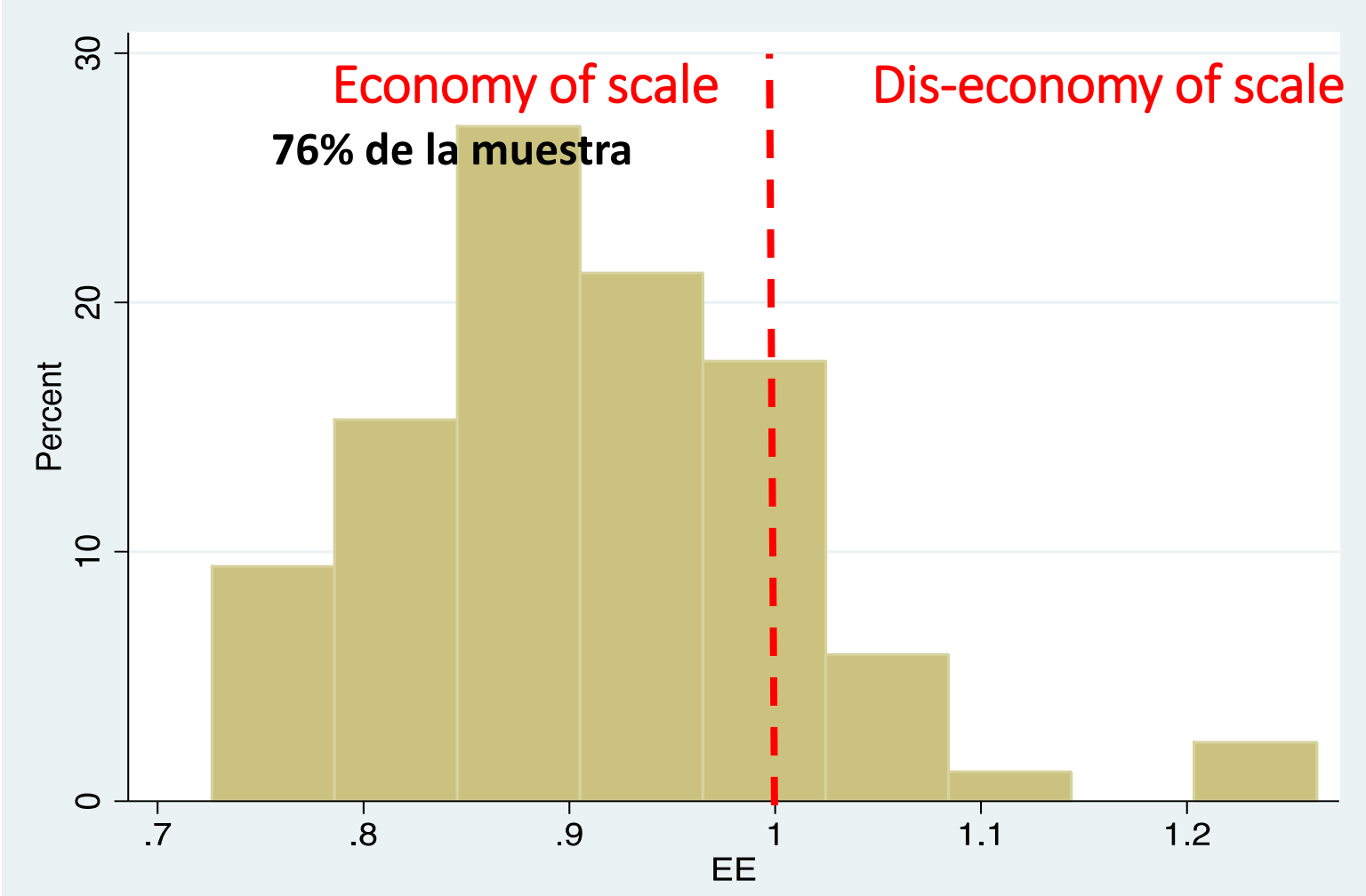
Technical Efficiency of milk production

Casos:

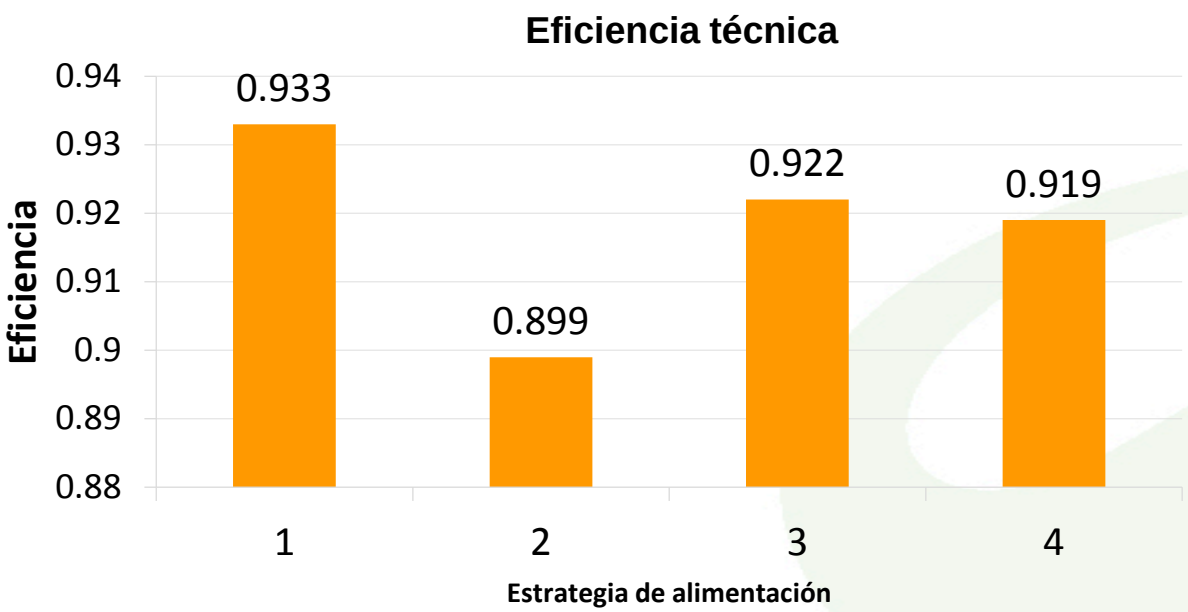
Variable	Indicador de eficiencia		
	0,68	**0,85**	**0,97**
Altitude (m)	1.600	400	100
Production system	Pastoreo	Semiestabulado	Semiestabulado
Grazing land size (ha)	30	13	22
Milk production (kg/day/animal)	17	12	13
Adult Animals	65	22	49
Animals in Production	47	17	42
Replacement Heifers	49	12	16
Employed Labor	7	1	2
Total Income (colones)	99.597.400	24.179.475	57.920.514
Total cost (colones)	116.707.660	20.527.922	44.143.910
Feeding cost (colones)	54.974.432	11.671.739	20.924.210
Labor cost (colones)	29.908.260	3.866.100	7.255.708
Net income (loss) (colones)	(17.110.260)	3.651.553	13.776.603

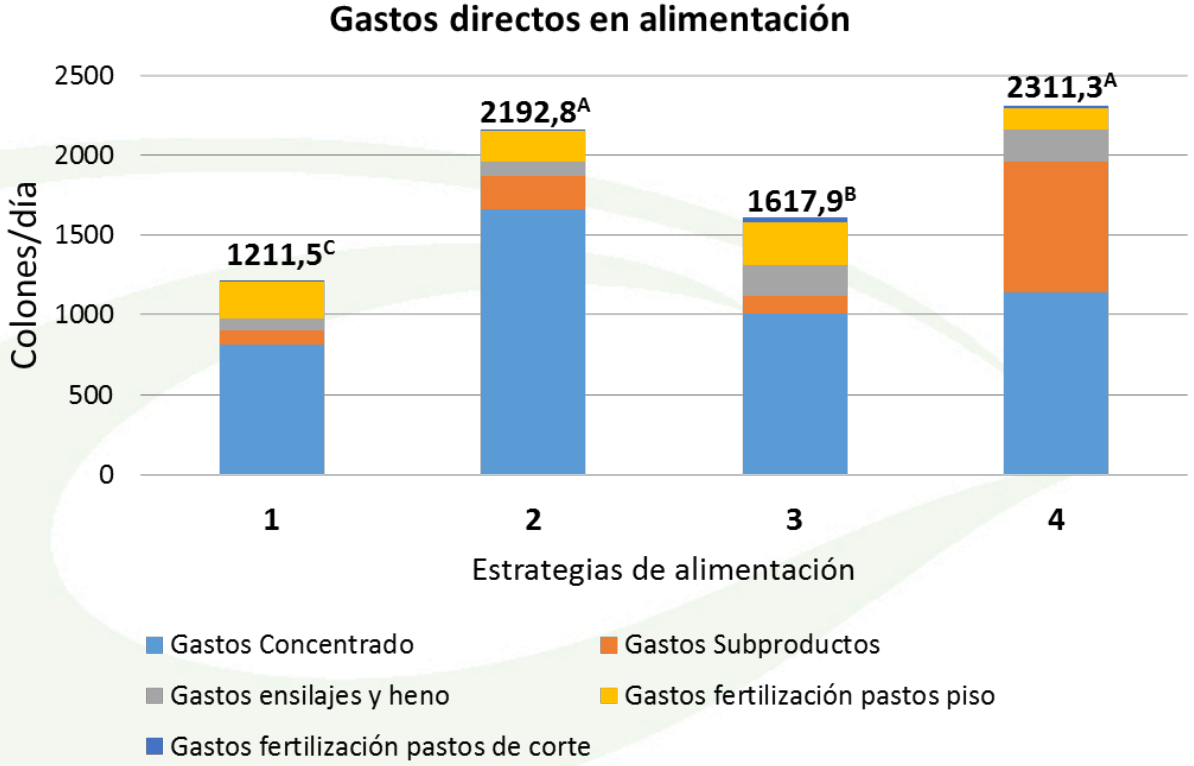
Economy of scale

There are factors that make the average cost per unit decrease as the scale of production increases

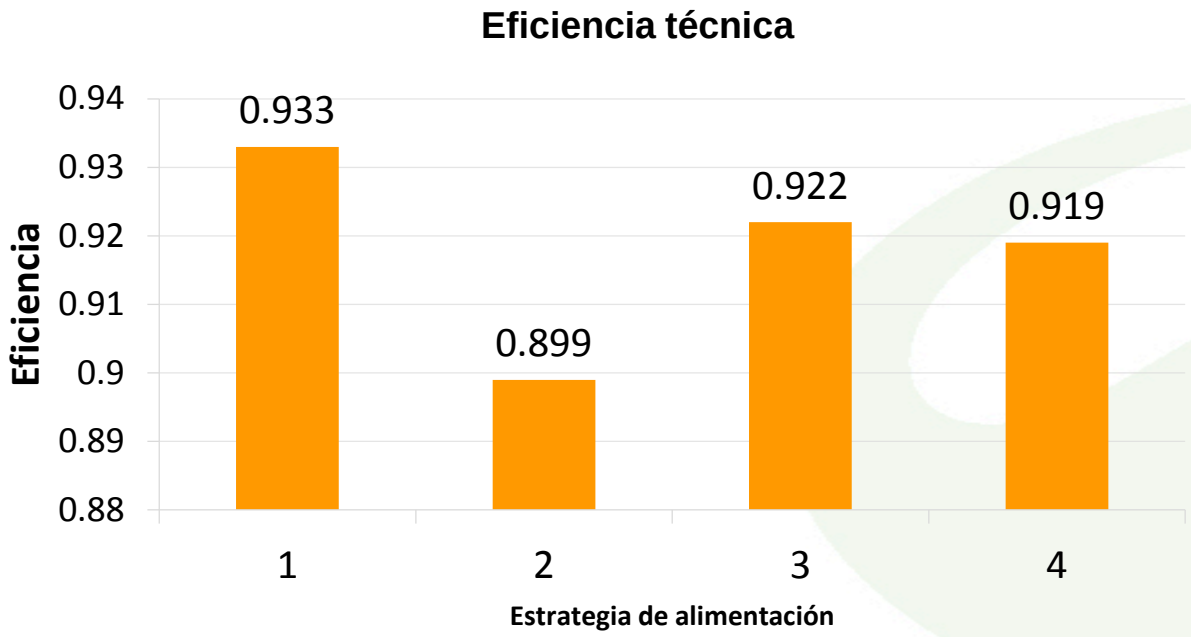


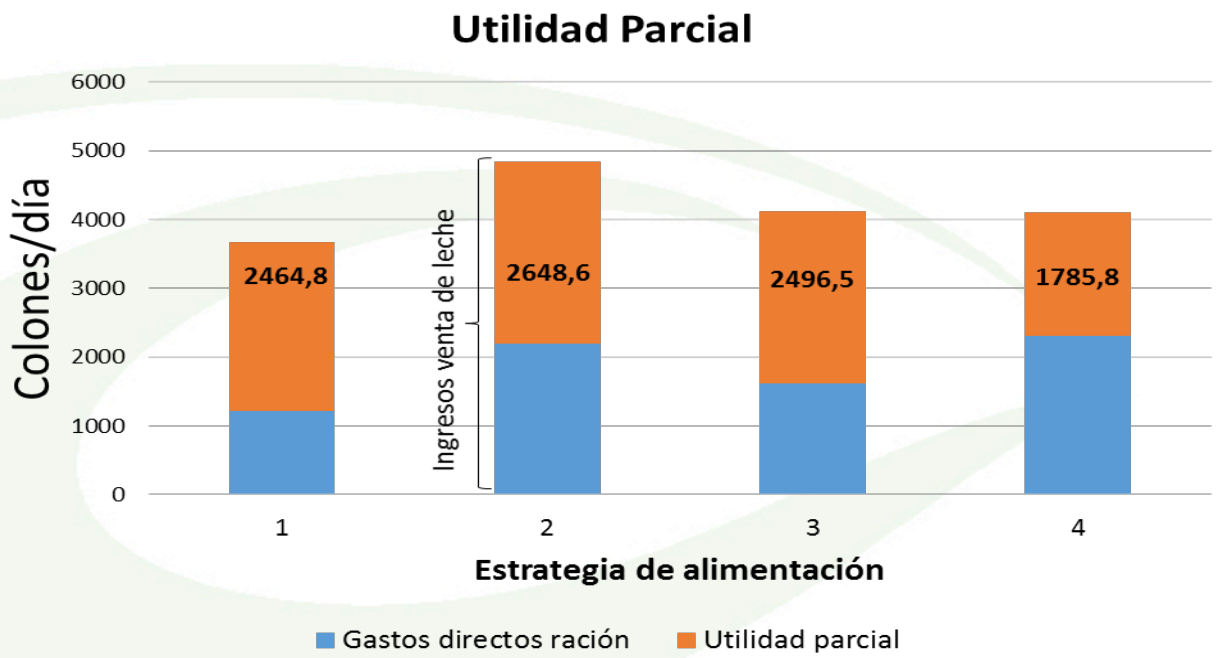
Farms with higher concentrates feeding levels are characterized with in average lower efficiencies





Income Over Feed Cost does not necessarily mean higher efficiencies





Considerations for the design of a low emission development in the dairy sector

Low Emission Strategy (LEDS)

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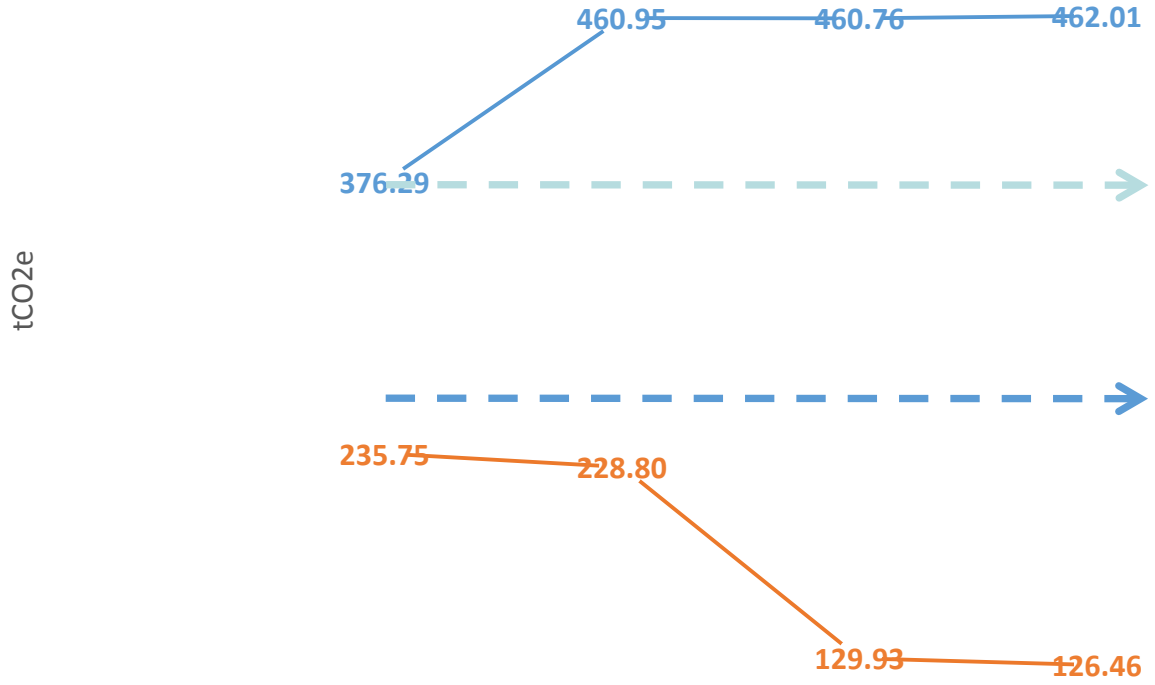
Emission Reduction

Reducción de emisiones

Carbon Balance

Fijación de carbono

Carbon offtake



	2004	2005	2006	2007
Carbon Sequestration	376.29	460.95	460.76	462.01
Emissions	235.75	228.80	129.93	126.46

Considerations for the design of a low emission development in the dairy sector

National Strategy of Carbon Neutrality

Low Emission Development Strategy for the Dairy Sector

- A instrument for orientation of national and institutional policies
- Requires institutional arrangements
- Need of a determined mitigation horizon
- Being flexible to generate adaptive capacities
- Sensitive to vulnerabilities and resilience building
- Low Emission Strategy need to incorporate legitimacy and reflective governance
- LED aims are voluntary and non-binding

Importance of Institutional Agreements

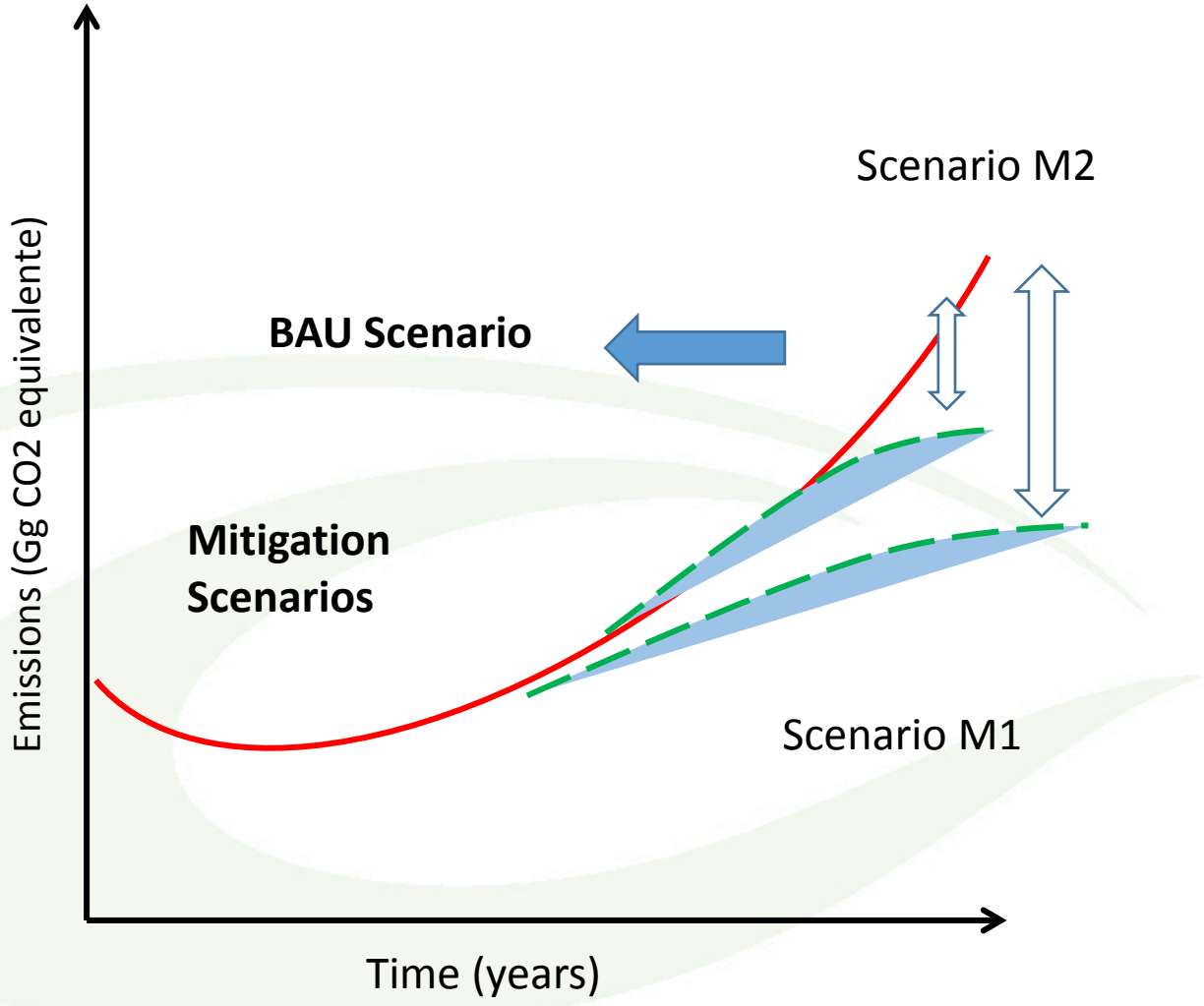
La importancia de los Acuerdos Institucionales

Implications of a Monitoring, Evaluation and Verification (MRV) system

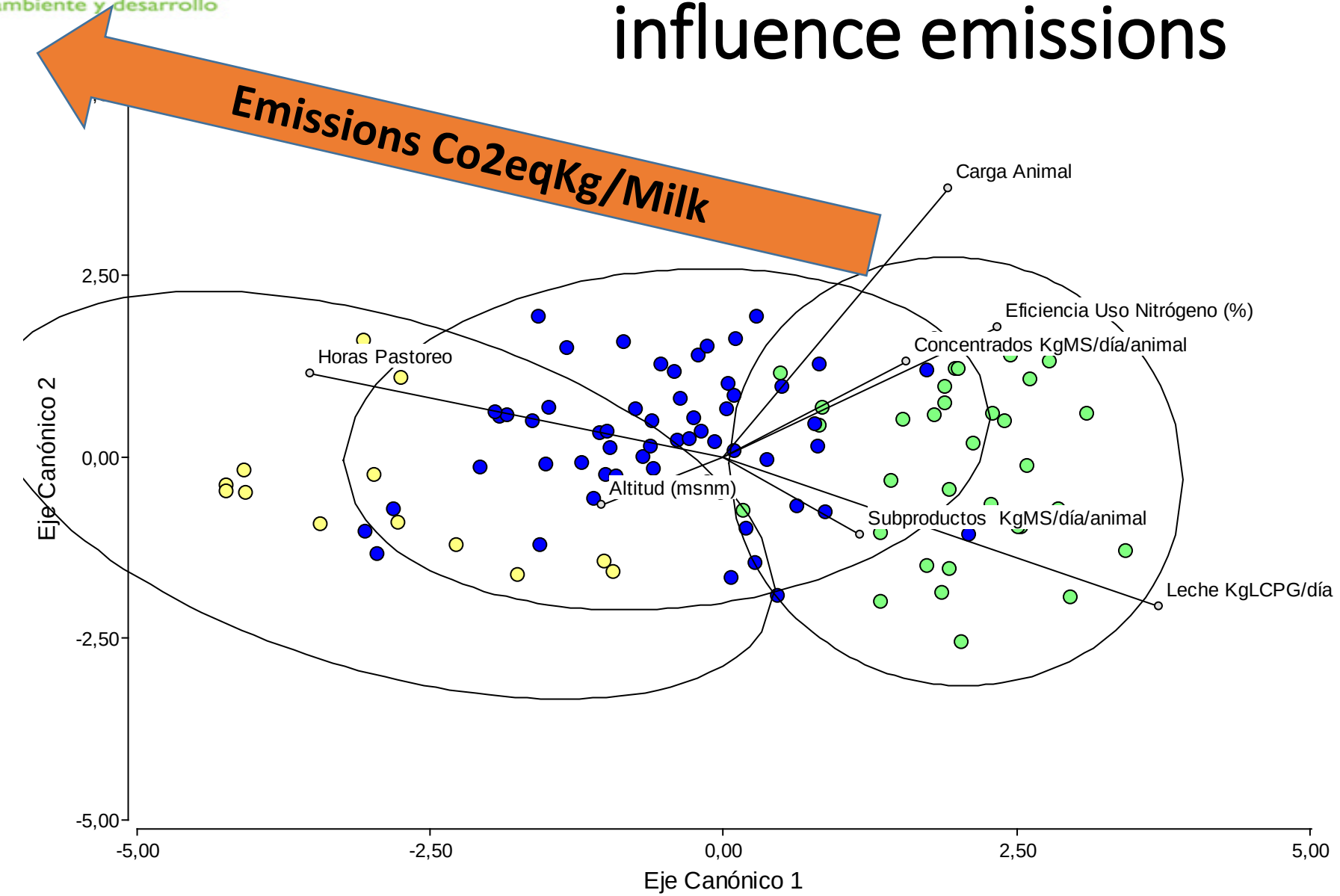
MRV

- Define key parameters to demonstrate the dynamics of emissions
- Define quality aspects of measurement
- Description of a measuring protocol
- Define a reporting system that is simple to be understood by other organizations.
- Define responsibilities in data collection.
- The verification process must be legitimate among stakeholders and should be carried out by an independent body

Actors



Determining Management Practices that influence emissions



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Thank you