

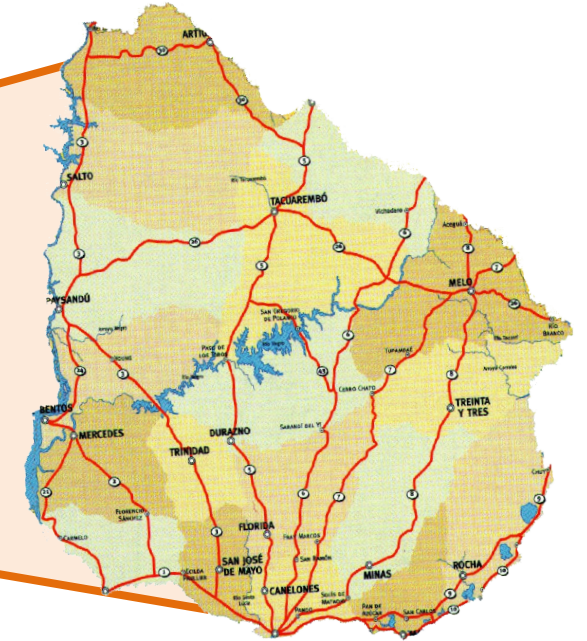


Replacement of total mixed ration with fresh alfalfa on productive performance, ruminal environment, and methane emissions of dairy COWS

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- Total area: 176.215 km²
- Population: 3.5 millions
- Cows: 12 millions
- Density: 19.5/km²
- Language: spanish
- 80% of exportations: agricultural products



Fuente: Uruguay XXI, 2019-2020. <https://www.uruguayxxi.gub.uy>

Background

Uruguayan dairy production systems rely on grazing temperate pastures, which has + and – aspects:



- + *Feeding low-cost, naturally produced, high-quality dairy products (nutraceuticals)*
- *the cows don't reach production levels as high as in TMR systems*

A **mixed system** (PMR + grazing) offers an alternative to increase individual milk yield while preserving some pasture benefits

Background

Methane emissions may increase as the proportion of forage in diets increases

BUT:

Improving pasture quality (44 vs. 60 % OMD) reduced 15 % the methane emitted (Ym) in grazing cattle

(Dini et al., 2017)



Hypothesis

Feeding dairy cows a mixed diet with a high-quality pasture, can improve rumen environment without increasing CH₄ emissions, maintaining milk production



Objective

To evaluate the impact of partially replacing a TMR with fresh alfalfa in lactating cows on intake, rumen environment, production, and CH₄ emissions



Materials and Methods

12 cows

150 DIM

545 kg BW

7000 kg



- housed in individual pens
- consuming a TMR
- randomly assigned to 2 groups
- 2 treatments, cross over design

Treatments

TMR

TMR 100%



PMR+A

TMR 70% + fresh alfalfa



Materials and Methods

Experimental protocol: 58 days

21 d adaptation



Period I

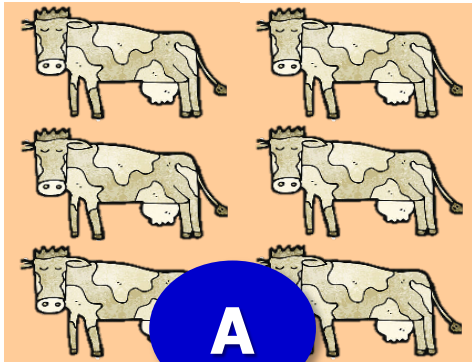
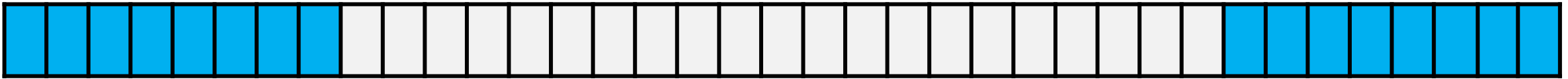
8 d

21 d

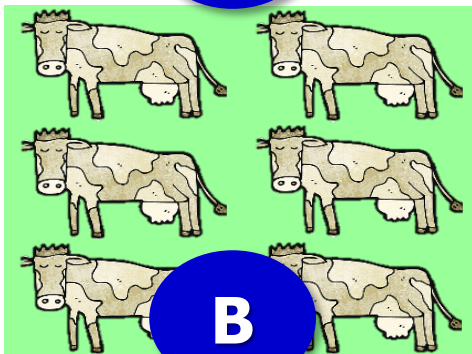


Period II

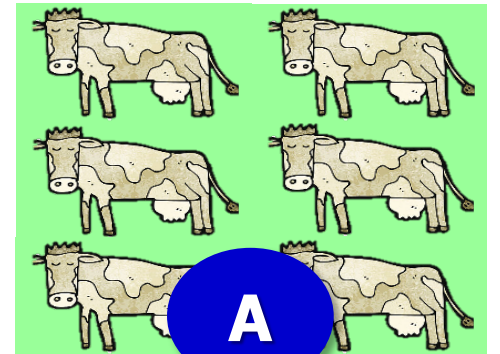
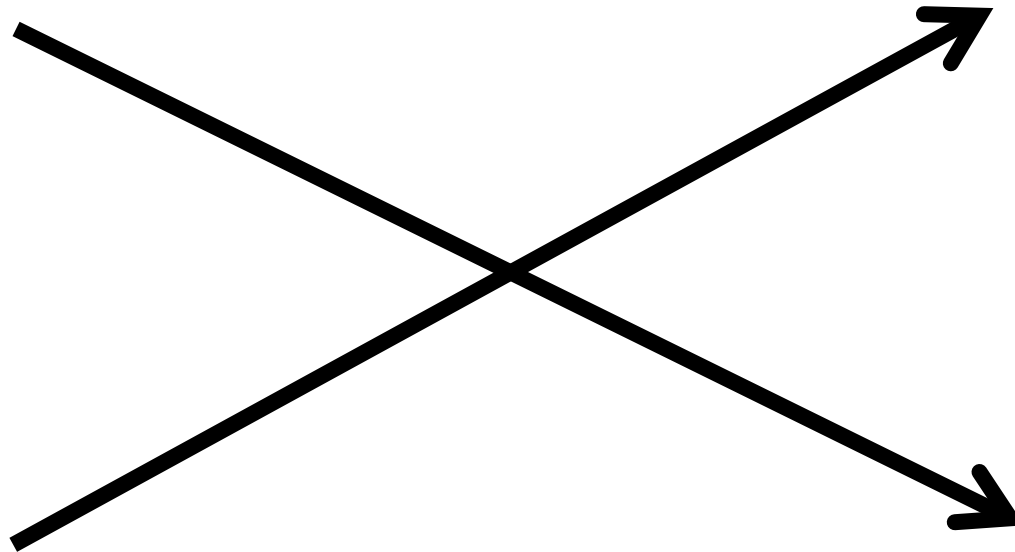
8 d



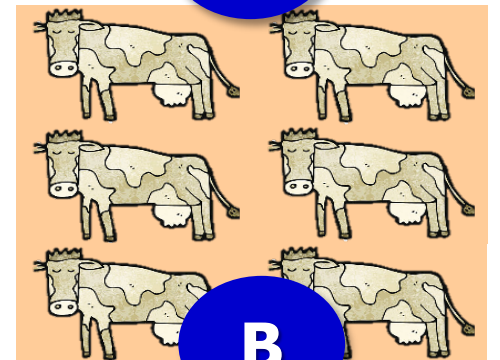
A



B



A



B

Materials and Methods



TMR/PMR

- formulated for 30 kg milk
- grass silage, corn, soybean meal, min & vit mix

Alfalfa

- 17% protein, 46% NDF
- p.m grazing
- unlimited quantity



Measurements: Intake



- 5 d
- **TMR:** offered – rejected
- **Alfalfa:** individual grazing paddocks, cut before and after grazing

Measurements: rumen environment

- 2 times/d, 2 different d
- 4 h after main meals (TMR/alfalfa)
- aspiration rumen content with oral tube



Measurements: CH₄

SF₆

(Sulfur hexafluoride)

- 5 d
- 2 periods
- GC determination CH₄, SF₆
- environment detection



Statistical analysis

Intake, ruminal pH, VFA and NH₃, milk production, CH₄ emissions:

$$Y_{ijk} = \mu + T_{ij} + P_k + (T \times P) + e_{ijk}$$

treatment (T_i) in j cows, period (P_k) and their interaction

Results



Intake and milk production

	TMR	PMR+A	SEM	P (trat)
TMR (kg, DM)	21.1	15.0	0.22	<0.01
Alfalfa (kg, DM)	-	3.4	-	-
Total (kg, DM)	21.1	18.4	0.24	<0.01
OM (kg)	19.5	16.8	0.22	<0.01
NDF (kg)	11.5	9.8	0.12	<0.01
CP (kg)	2.7	2.4	0.03	<0.01
Milk yield (kg)	24.2	25.8	1.25	ns
fat (%)	4.2	4.2	0.18	ns
protein (%)	3.5	3.4	0.10	ns

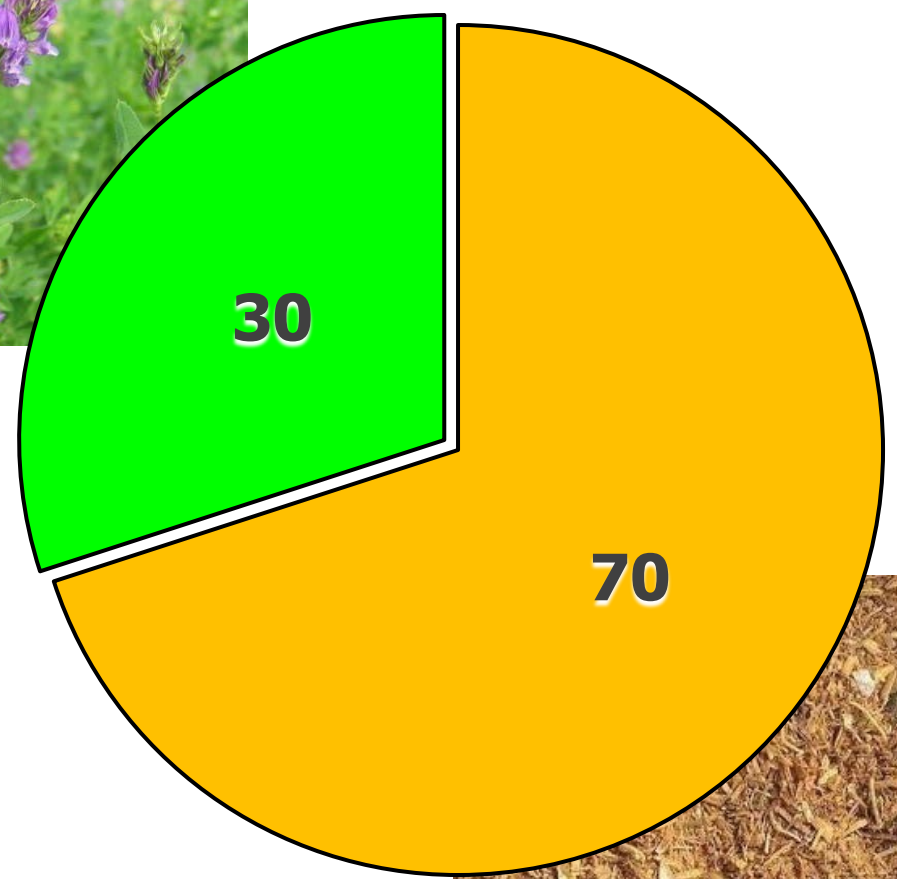
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Predicted

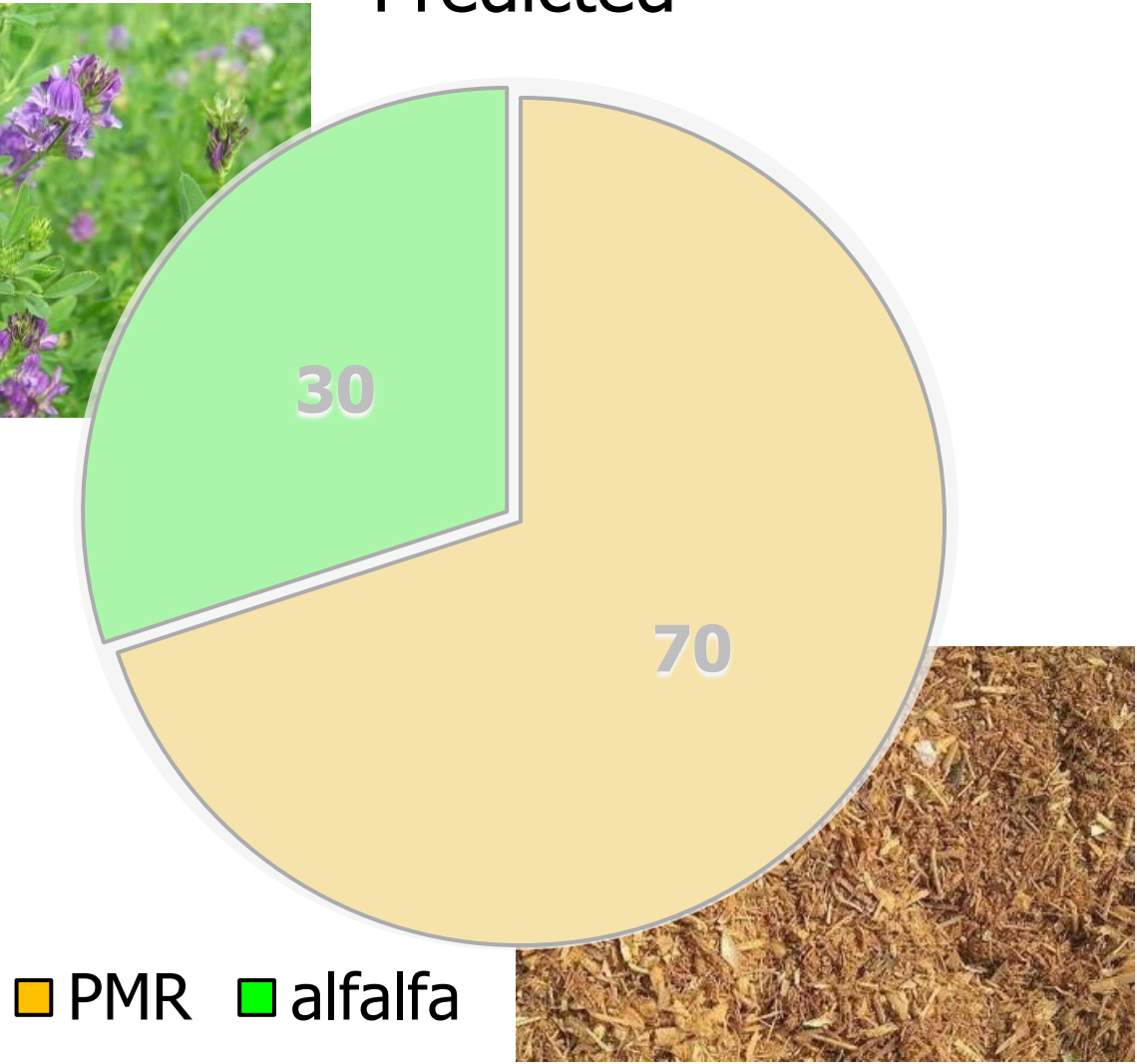


■ PMR ■ alfalfa

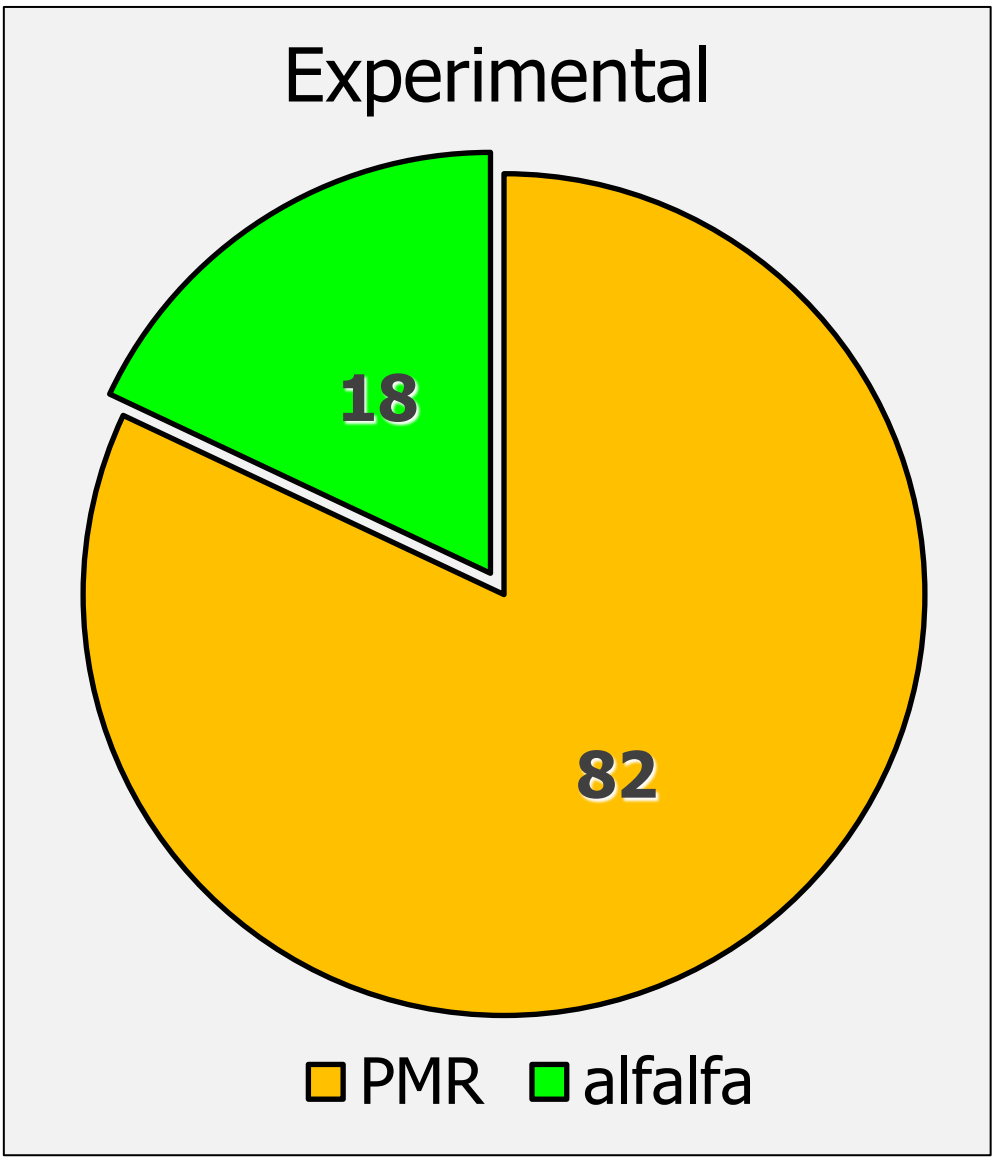


Intake

Predicted



Experimental



Rumen
(p.m. measurement)

	TMR	PMR+A	SEM	P (trat)
pH	6.20	6.43	0.095	0.01
VFA mM	44.4	41.8	2.62	ns
Propionic %	20.6	19.8	0.37	0.06
Acetic %	70.3	69.3	0.49	ns
Butyric %	10.5	11.1	0.47	0.03
ammonia %	10.5	11.4	0.99	ns

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Methane??



Methane

	TMR	PMR+A	SEM	P (trat)
CH ₄ (g/d)	523.5	523.0	32.2	ns
CH ₄ /DM ingested (g/kg)	24.9	28.55	1.66	0.03
CH ₄ /NDF ingested (g/kg)	47.8	54.3	3.19	0.04
CH ₄ /milk (g/kg)	22.3	20.6	2.01	ns
CH ₄ /Fat (g/kg)	543.5	502.5	39.8	ns
CH ₄ /Protein (g/kg)	637	618	52.5	ns

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In summary

- The partial substitution of TMR by fresh alfalfa forage in the diet reduced intake because of a low intake of alfalfa, which reached only 18% of the diet. However, both diets led to similar milk production.
- The diet with alfalfa had a higher ruminal pH and butyric concentration.
- Both diets led to a similar CH₄ emitted per day and CH₄ emission intensity.

Conclusion

The use of a mixed diet sustained milk production without increasing CH₄ emissions. Achieving a high intake of freshly grazed forage remains a challenge for high-yield dairy systems.



Questions?



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