EFFECT OF STOCKING RATE AND COW LACTATION STAGE ON NITROGEN BALANCE OF GRAZING DAIRY COWS

A.I. Roca-Fernández*, D. Báez-Bernal and A. González-Rodríguez

Agrarian Research Centre of Mabegondo (CIAM), INGACAL, Xunta de Galicia, Abegondo 10, 15080, La Coruña, Spain. *anairf@ciam.es

EAAP 2013
64th ANNUAL MEETING OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE
AUGUST 26TH - 30TH, 2013
NANTES, FRANCE

TABLE OF CONTENTS

I. Background

II. Introduction

III. Objectives

IV. Material and Methods

V. Results

VI. Conclusions

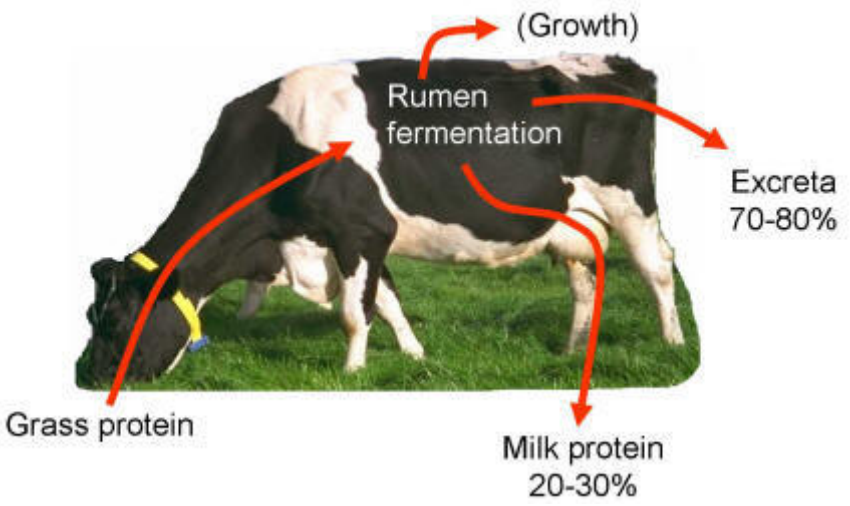
I. BACKGROUND

The **main N input at a cow level** is **via feed**:

To improve grazing dairy management systems by applying appropriate stocking rates (SR) on the farm while **decreasing levels of supplementation at pasture according to cows' lactation stage** (LS).

Where is feed protein?

N balance at a cow level



II. INTRODUCTION

There are **important biological** and **economical reasons** to **reduce N losses** and **improve its utilization in dairy cattle**:

- **Excessive N intake** causes **low reproduction** and **low efficiency in BW**.
- **Low efficiency of protein utilization in grazing dairy systems**.

Improved feed N utilization feeding efficiency can be got by:

- **Feeding dairy cows according to their production levels** (grouping animals according to lactation stage).
- **Using properly balanced diets** (the goal is maximize protein utilization by making sure that total protein is not overfed and rumen degradable and un-degradable protein is balanced).

III. OBJECTIVES

To investigate the **effect of stocking rate** (**SR**) and **cows' lactation stage** (**LS**) on **animal N-balance** in **two periods (P) of supplementation at pasture**.

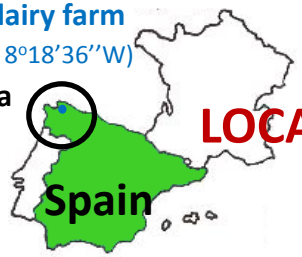
To determine the **N-conversion rate** from **∑N inputs** (grass, grass/maize silage and concentrate) to **∑N outputs** (milk and body weight gain) in order to **decrease the N-surplus** by **improving efficiency of N utilization** at the animal level.

64th EAAP 2013
ANNUAL MEETING OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE
AUGUST 26TH - 30TH, 2013
NANTES, FRANCE

IV. MATERIAL AND METHODS

LOCATION

CIAM dairy farm
(43º12'24''N; 8º18'36''W)



EXPERIMENTAL DESIGN

A **randomized block design** was established by **a 2×2 factorial** arrangement of **4 treatments** (**LE**, **LM**, **HE** and **HM**):

two stocking rates and **two lactation stages**

(SR, cows/ha) → (**L**, 3-4) vs. (**H**, 5-6)

(LS, days in milk) → (**E**, 31) vs. (**M**, 140)

two periods of supplementation at pasture

(silage + concentrate) → (**P1**) (**P2**)

ANIMALS & PASTURES

HF cows (n=72) grazing rotationally on ryegrass + legume pastures

SWARD & ANIMAL DETERMINATIONS

Pasture: pre-/post-grazing SH, HM, DHA, SR and sward quality (CP, fibers, WSC and OMD) determined by NIRS.

Animal: BW, BCS, MY and milk quality (protein).

∑N inputs: Total intake/Nutritive value G+S+C.

∑N outputs: MY (daily) and BW (weekly).

∑N inputs - ∑N outputs: N excretion (urine + faeces).

V. RESULTS

Animal performance and milk quality responses

Herds	Cows (number)	Lactation (days)	Stocking rate (cows/ha)	Milk (kg/cow/day)	Protein (g/kg DM)	Fat (g/kg DM)	BW (kg)	BCS (1-5)
LE	22	33^{a}	4.3^{a}	24.9^{a}	29.2^{a}	35.6^{a}	573^{ab}	2.8^{a}
HE	22	28^{a}	5.8^{b}	26.5^{a}	28.7^{a}	36.3^{ab}	564^{a}	2.7^{a}
LM	14	139^{b}	3.6^{a}	20.4^{b}	30.6^{b}	39.3^{b}	600^{b}	2.9^{b}
HM	14	140^{b}	4.6^{b}	18.9^{b}	31.6^{b}	36.8^{ab}	574^{ab}	3.0^{b}

E lactacion stage (31) **cows** showed **lower** DIM than **M lactation stage** (140) **cows**.

Imposed SR were **higher** (P<0.05) in cows at **H** (5.2 cows/ha) than at **L** (3.9 cows/ha) **SR**.

MY (kg/cow/day) was **higher** (P<0.05) in cows at **E** (25.7) than at **M lactation stage** (19.6).

Milk protein, fat, BW and **BCS** were **higher** (P<0.05) in cows at **M** than at **E lactation stage.**

V. RESULTS

Total feed intake and sward quality characteristics

	Total intake								Sward characteristics					
	Pasture		Grass silage		Maize silage		Concentrate		DM	CP	ADF	NDF	WSC	IVOMD
	P1	P2	P1	P2	P1	P2	P1	P2						
Herds	(kg DM/cow/day)								(%)	(g/kg DM)				
LE	18.8^{a}	14.2^{a}	1.5	0	1.7	0	4.1^{a}	1.8^{a}	17.3^{a}	131^{a}	275^{a}	487^{a}	185^{a}	749^{a}
HE	16.4^{a}	18.2^{a}	1.5	0	1.7	0	4.1^{a}	1.8^{a}	16.9^{b}	149^{ab}	261^{b}	475^{b}	193^{a}	759^{ab}
LM	25.9^{b}	21.0^{b}	1.8	0	2.0	0	2.6^{b}	0^{b}	18.5^{a}	146^{ab}	278^{a}	505^{a}	74^{b}	757^{ab}
HM	21.0^{b}	17.6^{b}	1.8	0	2.0	0	3.3^{b}	0^{b}	16.7^{b}	157^{b}	266^{b}	483^{ab}	177^{b}	790^{b}

Pasture and **silage DM intake** were **higher** (P<0.001) in cows at **M** than at **E** **lactation stage.**

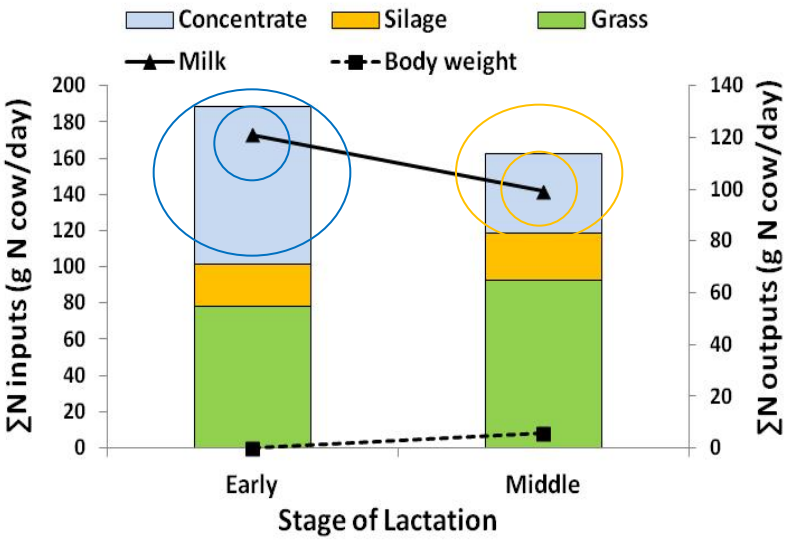
Concentrate DM intake was **higher** (P<0.001) in cows at **E** than at **M** **lactation stage.**

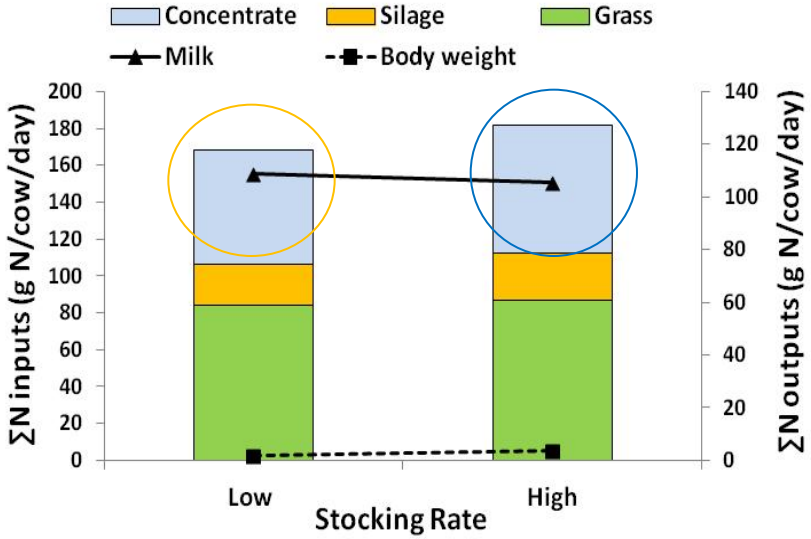
DM (16.8 *vs.* 18%), **ADF** (264 *vs.* 277 g/kg DM) and **NDF** (479 *vs.* 496 g/kg DM) content were **lower** (P<0.05) in cows managed at H than at **L** **stocking rate**.

WSC were **higher** in cows managed at E than at **M** **lactation stage**.

V. RESULTS

∑N inputs (G+S+C) and ∑N outputs (M+BW) (g N/cow/day)





∑N inputs from concentrate and **∑N outputs from milk** were **higher** (P<0.001) at **E** than at **M** **lactation stage.**

∑N inputs from concentrate were **higher** (P<0.01) in cows managed at **H** than at **L** **stocking rate**.

V. RESULTS

∑N inputs, ∑N outputs and N excretion (g N/cow/day)

Groups[1]	LE		HE		LM		HM		Significance[3]						
Periods[2]	P1	P2	P1	P2	P1	P2	P1	P2	LS	SR	P	LSxSR	LSxP	SRxP	LSxSRxP
Grass	68	67	83	95	105	95	83	87	ns	ns	ns	ns	ns	ns	ns
Grass silage	26	0	30	0	31	0	31	0	ns	ns	***	ns	ns	ns	ns
Maize silage	17	0	20	0	20	0	21	0	ns	ns	***	ns	ns	ns	ns
Concentrate	121	51	121	56	74	3	97	3	***	*	***	ns	*	ns	*
∑N inputs	232	118	254	151	230	98	232	90	***	***	***	***	ns	**	*
Milk output	143	90	150	101	124	78	122	73	***	ns	***	**	ns	ns	ns
Body weight gain	-6	-3	10	-1	10	7	8	-2	ns	ns	ns	ns	ns	ns	ns
∑N outputs	137	87	160	100	134	85	130	71	***	*	***	**	**	***	**
∑N inputs-∑N outputs	95	30	94	50	96	12	102	18	ns	ns	***	ns	ns	ns	ns
N excretion	442	56	356	119	466	-6	576	41	ns	ns	***	ns	ns	ns	ns

[1]Groups: Stocking Rate (L, Low vs. H, High) x Stage of Lactation (E, Early vs. L, Late) [2]Periods of the Grazing Season (P1, March-April *vs.* P2, May-August); [3]Significance:*** (P<0.001); ** (P<0.01); * (P<0.05); ns, not significant.

∑N inputs from silage (G + M) and **concentrate** were **higher** (P<0.001) in **P1** than in **P2**.

∑N outputs from milk were **higher** (P<0.001) in **P1** than in **P2**.

∑N inputs - ∑N outputs and **N excretion** were also **higher** (P<0.001) in **P1** than in **P2**.

No differences were found **between LS** and **SR** for **∑N inputs - ∑N outputs** and **N excretion**.

VI. CONCLUSIONS

1.-The results pointed the interest of evaluating **cows' lactation stage** and **stocking rate** on **∑N inputs** and **∑N outputs** to **minimize N-losses at the animal level**.

2.- **Higher ∑N inputs** and **∑N outputs** were found in **cows at early** than **at middle lactation stage**.

3.- **Higher ∑N inputs** and **∑N outputs** were reached **at high** than **at low stocking rate**.

4.- **∑N inputs** and **∑N outputs** were **higher in P1** than **in P2** and **supplementation** (concentrate + silage) **highly increased N-excretion in grazing dairy cows**.

ACKNOWLEDGMENTS

THANK YOU VERY MUCH FOR YOUR ATTENTION

ANY QUESTIONS? …

MINISTERIO DE CIENCIA E INNOVACIÓN
INIA Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria
XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL
medio rural
INGACAL INSTITUTO GALLEGO DE CALIDADE ALIMENTARIA

EFFECT OF STOCKING RATE AND COW LACTATION STAGE ON NITROGEN OF GRAZING DAIRY COWS

A.I. Roca-Fernández*, D. Báez-Bernal and A. González-Rodríguez

Agrarian Research Centre of Mabegondo (CIAM), INGACAL, Xunta de Galicia, Abegondo 10, 15080, La Coruña, Spain. *anairf@ciam.es

EAAP 2013
64th ANNUAL MEETING OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE
AUGUST 26TH - 30TH, 2013
NANTES, FRANCE