UNIVERSITÀ DEGLI STUDI DI PALERMO

ACCADEMIA DEI GEORGOFILI

ROTA GUIDO

Moderni ricoveri e strutture varie per la zootecnia bovina da latte: riflessi sull'ambiente e sul benessere animale

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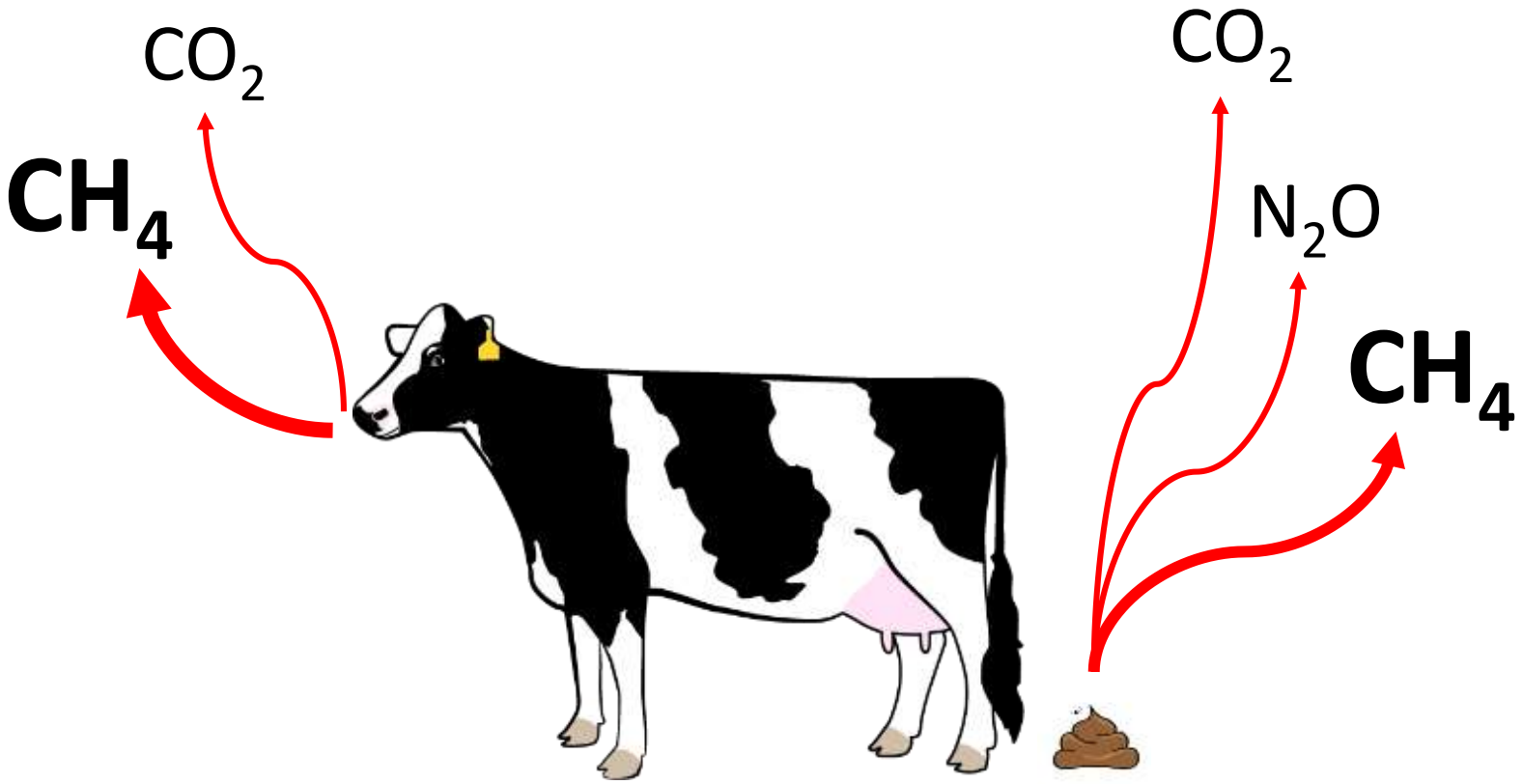
Università degli Studi di Palermo
Rota Guido Srl

CONVEGNO
RAZIONALIZZAZIONE DEI SISTEMI COLTURALI E ZOOTECNICI PER LA SALVAGUARDIA AMBIENTALE
13-14 novembre 2024
Accademia dei Georgofili, Logge Uffizi Corti - Firenze


CO_2
CH_4
CO_2
N_2O
CH_4

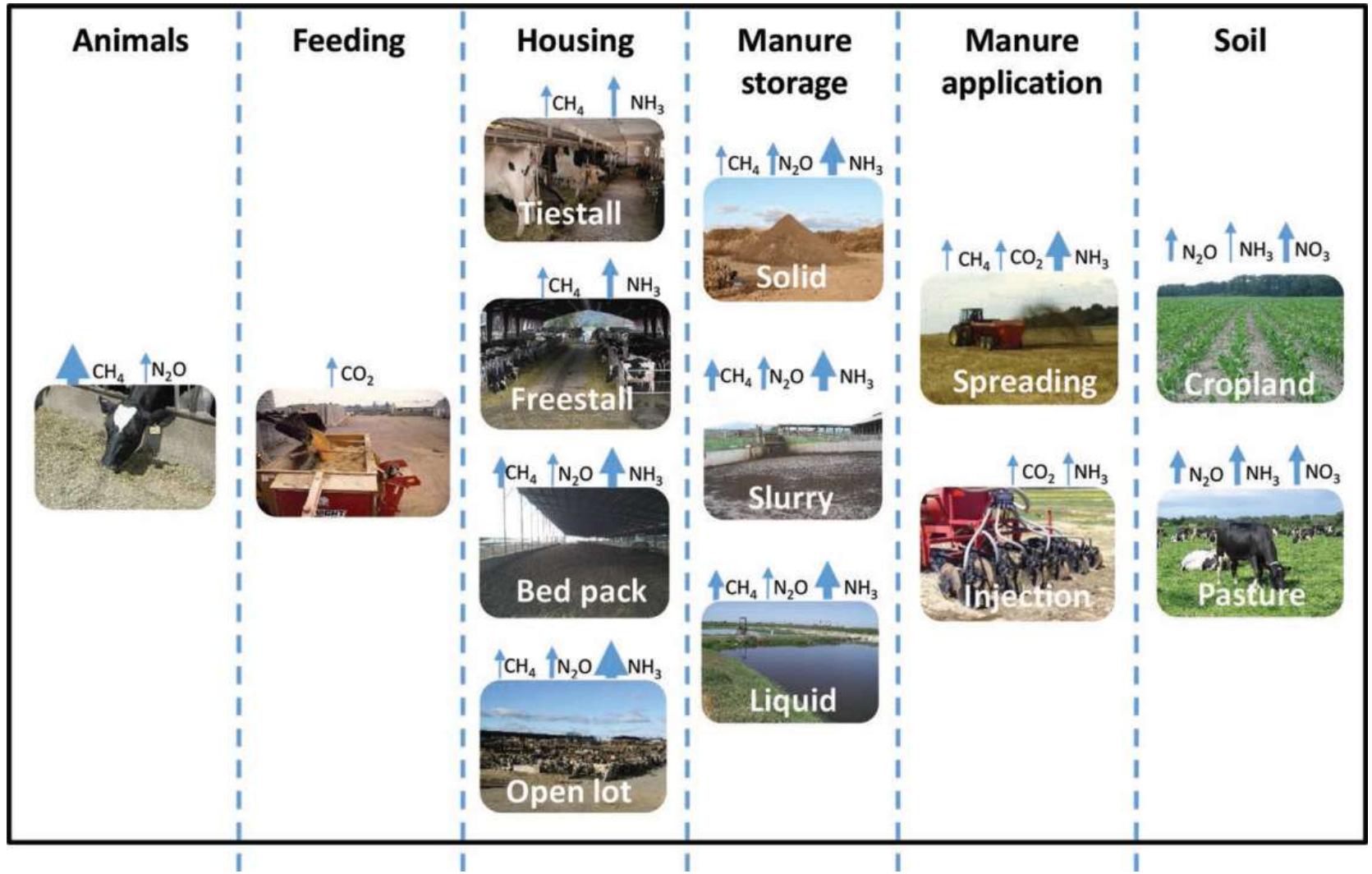
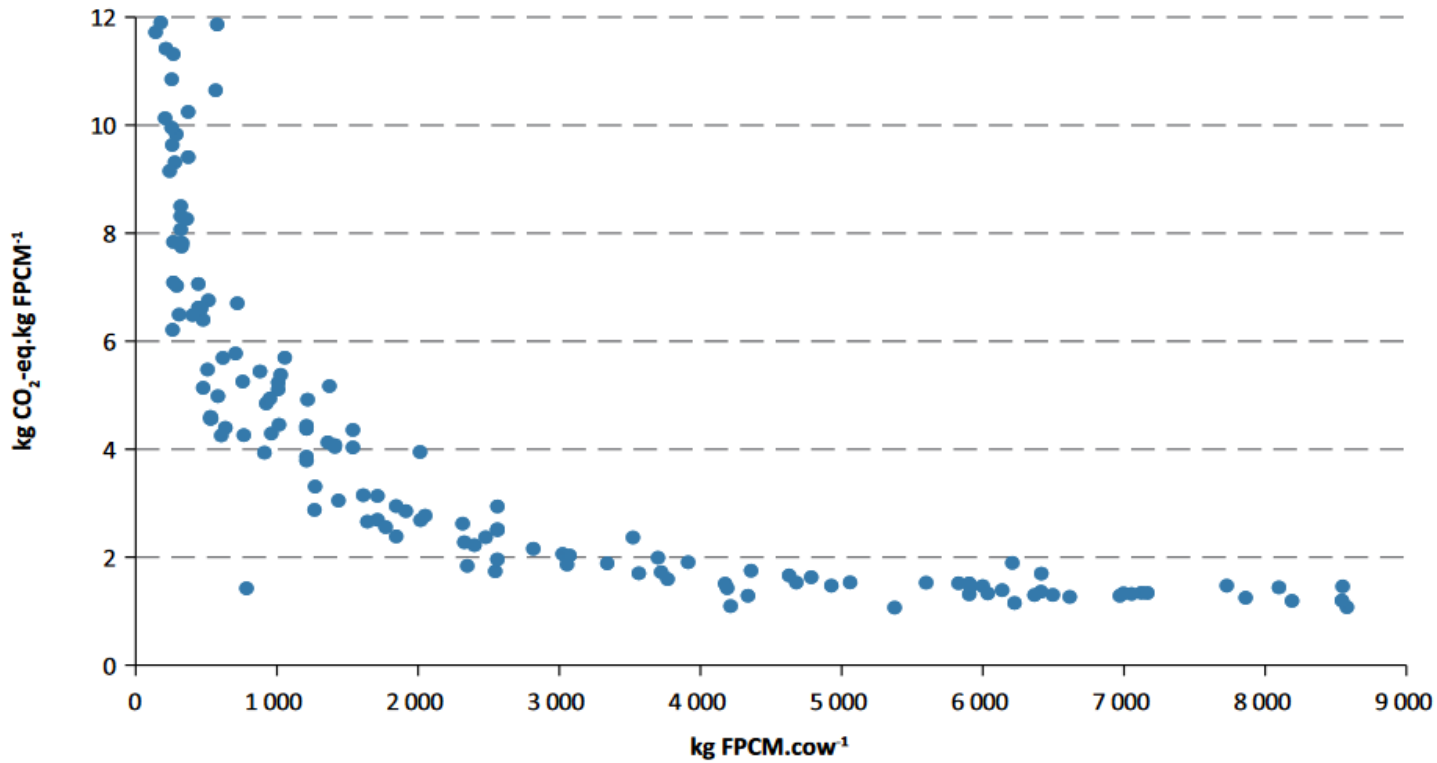

Animals
Feeding
Housing
Manure storage
Manure application
Soil
CH4 N2O
CO2
CH4 NH3
Tiestall
CH4 NH3
Freestall
CH4 N2O NH3
Bed pack
CH4 N2O NH3
Open lot
CH4 N2O NH3
Solid
CH4 N2O NH3
Slurry
CH4 N2O NH3
Liquid
CH4 CO2 NH3
Spreading
CO2 NH3
Injection
N2O NH3 NO3
Cropland
N2O NH3 NO3
Pasture

FIGURE 23. Relationship between productivity and emission intensity of milk (country averages)



Source: Gerber *et al.*, 2011.

BENESSERE ANIMALE vs EMISSIONI

Table 3
Potential mitigating effect of improved animal welfare and productivity on GHG and NH_3 emissions from dairy farming.

Welfare and productivity aspects	Emission mitigation potential	Reference
Improved fertility[1]	10–16% of CH_4/ cow (21–24% of CH_4/ herd) 8% of NH_3/ cow (17% of CH_4/ herd)	Garnsworthy (2004)
Improved longevity[2]	6.9kg CO_2-eq/ cow* 0.044 kg CO_2-eq/ kg milk solids*	Bell et al. (2015)
Improved health	up to 25% of GHG/ unit of product**	Chatterton et al. (2014)
Lameness	30 kg CO_2-eq/ t ECM on herd level***	Chen et al. (2016)
Subclinical ketosis	18.4 kg CO_2-eq/ t FPCM per case	Mostert et al. (2016)
Mastitis	55.5 kg CO_2-eq/ t FPCM per case	Mostert et al. (2017)
Increased DMI	2–6% of CH_4/ kg ECM (per kg DMI increase)	Knapp et al. (2014)
Reduced animal mortality (culling rate)	≤10% of CH_4 and N_2O/ unit of product****	Hristov et al. (2013)

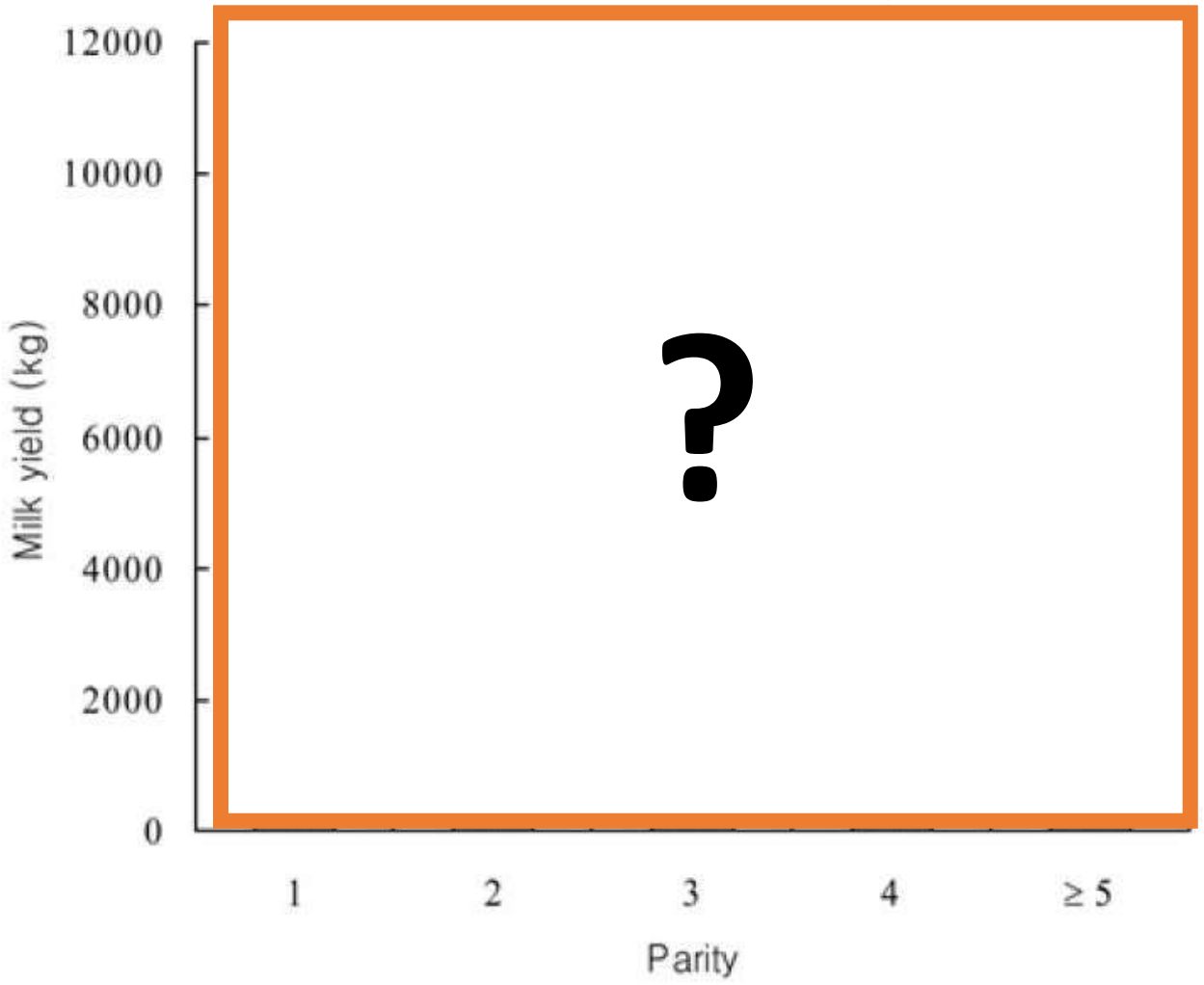
[1]Ideal fertility rate, with oestrus detection rates of 70% and conceptions rates at first service of 65% – achievable with appropriate management, nutrition and genetics.
[2]Increasing survival by 1% per lactation.
*Mitigating effect might be reduced due to emissions from an increased number of off-spring used for beef production (de Boer et al., 2011).
Magnitude of mitigation effect depends on the disease, expressed per 1,000 litres of fat and energy corrected milk (FPCM**).
***Values based on a modelled lameness prevalence reduction from 28% to 15% and an associated increase in milk yield of 1.8 kg per cow and day.
****Values uncertain, due to limited research.

- CHETOSI SUBCLINICA -> **2%** CO_2eq/kg FPCM
- MASTITE CLINICA-> **6,2%** CO_2eq/kg FPCM
- ZOPPIE-> **1,5%** CO_2eq/kg FPCM
- LONGEVITA'-> **14-19%** CO_2eq/kg FPCM

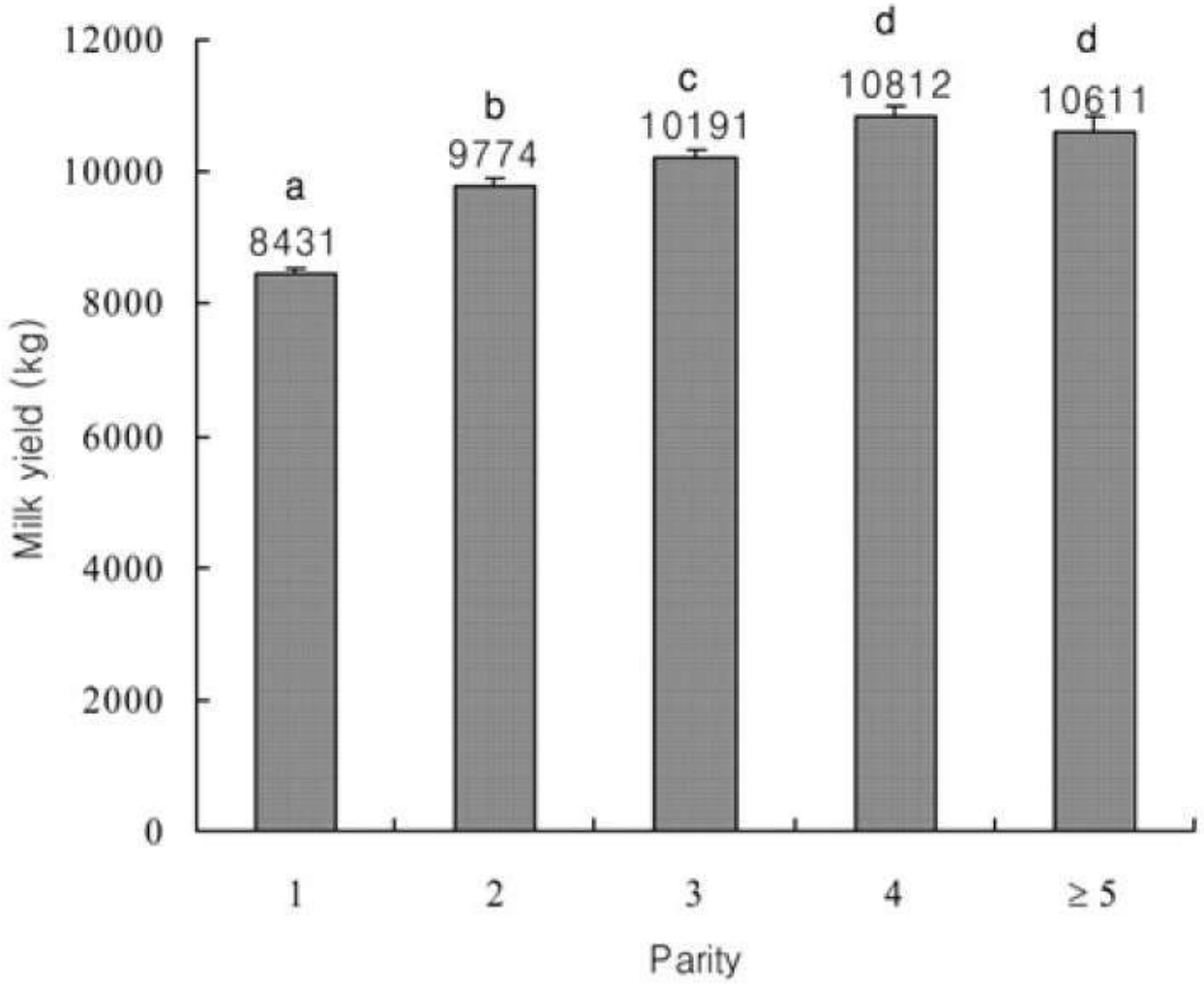
SITUAZIONE BENESSERE ANIMALE (VACCHE LATTE) IN ITALIA

- Il benessere delle vacche da latte (nei sistemi confinati) è relativamente basso… In Italia è spesso inferiore al resto d'Europa
- EFSA (2009): "L'incidenza delle patologie (podali) negli allevamenti di vacche da latte (*ZG) è inaccettabile"…

- Alcuni dati:
  - **Italia 2° paese in Europa per quantità di antibiotici utilizzati a scopi zootecnici** (dietro solo a Cipro!; ECDC, EFSA, EMA; 2017)
  - Incidenza **zoppie**: **~25%** (Cook, 2016)
  - Incidenza **mastiti** (>200.000 SCC): **26,1 %** (AIA, 2018)
  - N. medio **lattazione**: **2,4** (AIA, 2018)
  - Tasso di **rimonta**: **34%** (Zanini, 2016)



Lee and Kim. J Vet Sci. 2006 Jun; 7(2): 161–166



Lee and Kim. J Vet Sci. 2006 Jun; 7(2): 161–166

OK, QUINDI COME AUMENTARE BENESSERE ANIMALE (E QUINDI RIDURRE EMISSIONI)?

- Cow Comfort (tempo di riposo)
- Igiene lettiere e pavimentazioni
- Ventilazione
- **Benessere durante asciutta e transizione**

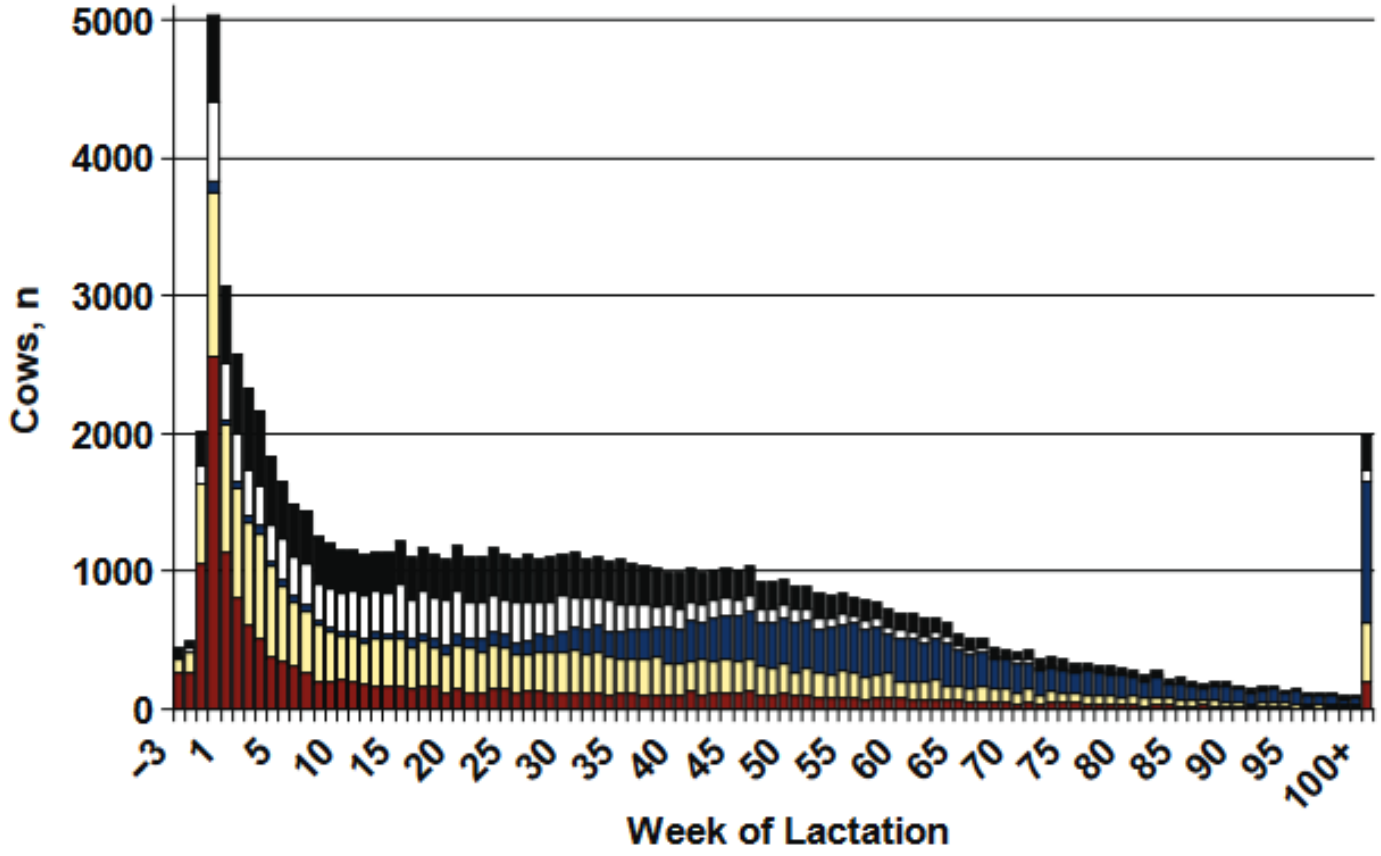
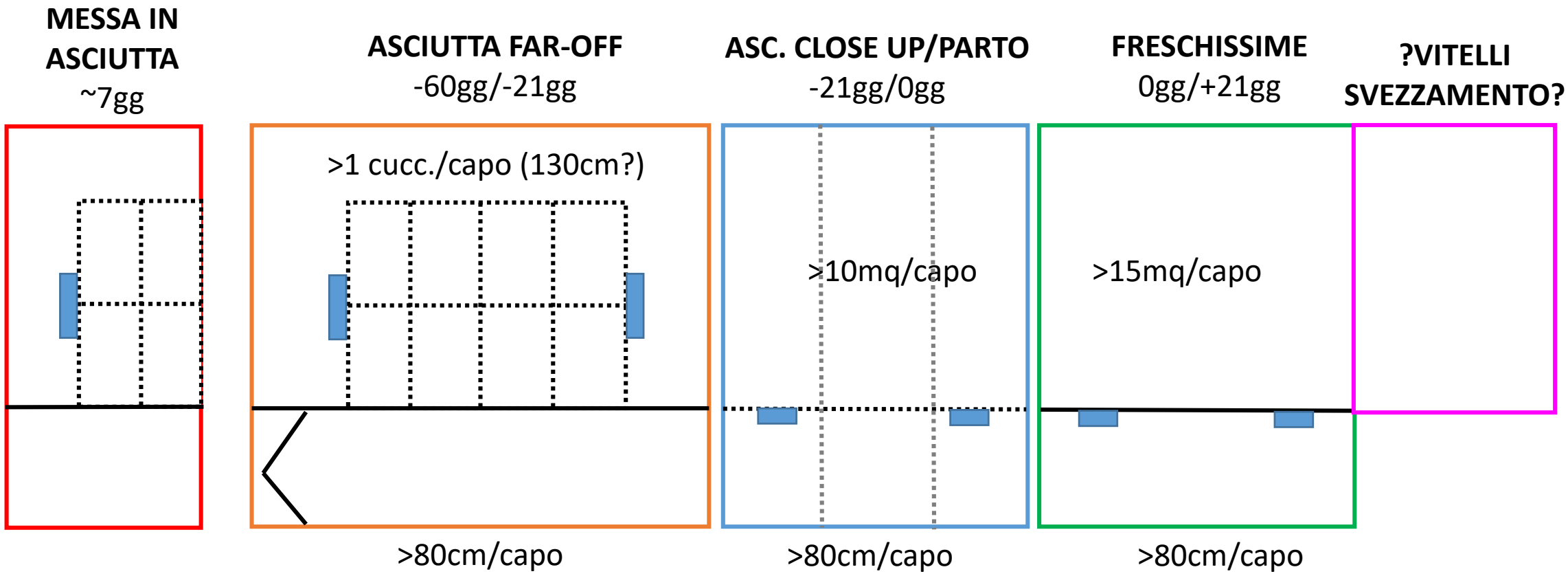


Figure 1. Total number of cows (n) that died (red), or were culled with codes corresponding to reproduction (blue), injury/other (yellow), mastitis (white), and all other reasons (black) by week of lactation.

Dechow and Goodling. J Dairy Sci. 2008 Dec; 91(12): 4630–4639

QUINDI, COME PROGETTARE GLI AMBIENTI DEDICATI ALLA ASCIUTTA/TRANSIZIONE?


MESSA IN ASCIUTTA
~7gg
ASCIUTTA FAR-OFF
-60gg/-21gg
>1 cucc./capo (130cm?)
ASC. CLOSE UP/PARTO
-21gg/0gg
>10mq/capo
FRESCHISSIME
0gg/+21gg
>15mq/capo
?VITELLI SVEZZAMENTO?
>80cm/capo
>80cm/capo
>80cm/capo

MESSA IN ASCIUTTA
~7gg

ASCIUTTA FAR-OFF
-60gg/-21gg

ASC. CLOSE UP/PARTO
-21gg/0gg

FRESCHISSIME
0gg/+21gg

?VITELLI SVEZZAMENTO?

>1 cucc./capo (130cm?)

>10mq/capo

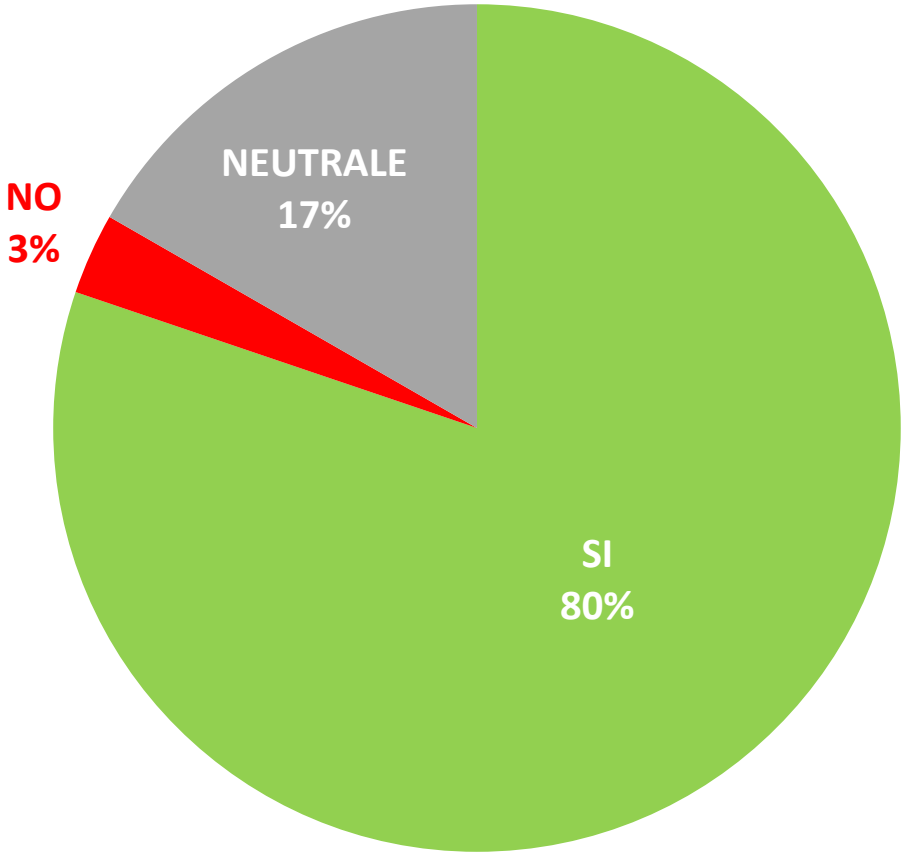
>15mq/capo

>80cm/capo

>80cm/capo

>80cm/capo

LE VACCHE DA LATTE DOVREBBERO AVERE ACCESSO AL PASCOLO?



Schuppli et al., 2014. J. Anim. Sci. 92:5185-5192

J. Dairy Sci. TBC
https://doi.org/10.3168/jds.2022-23107

Free-choice pasture access for dry cows: effects on health, behavior and milk production

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UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI
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PARMIGIANO REGGIANO

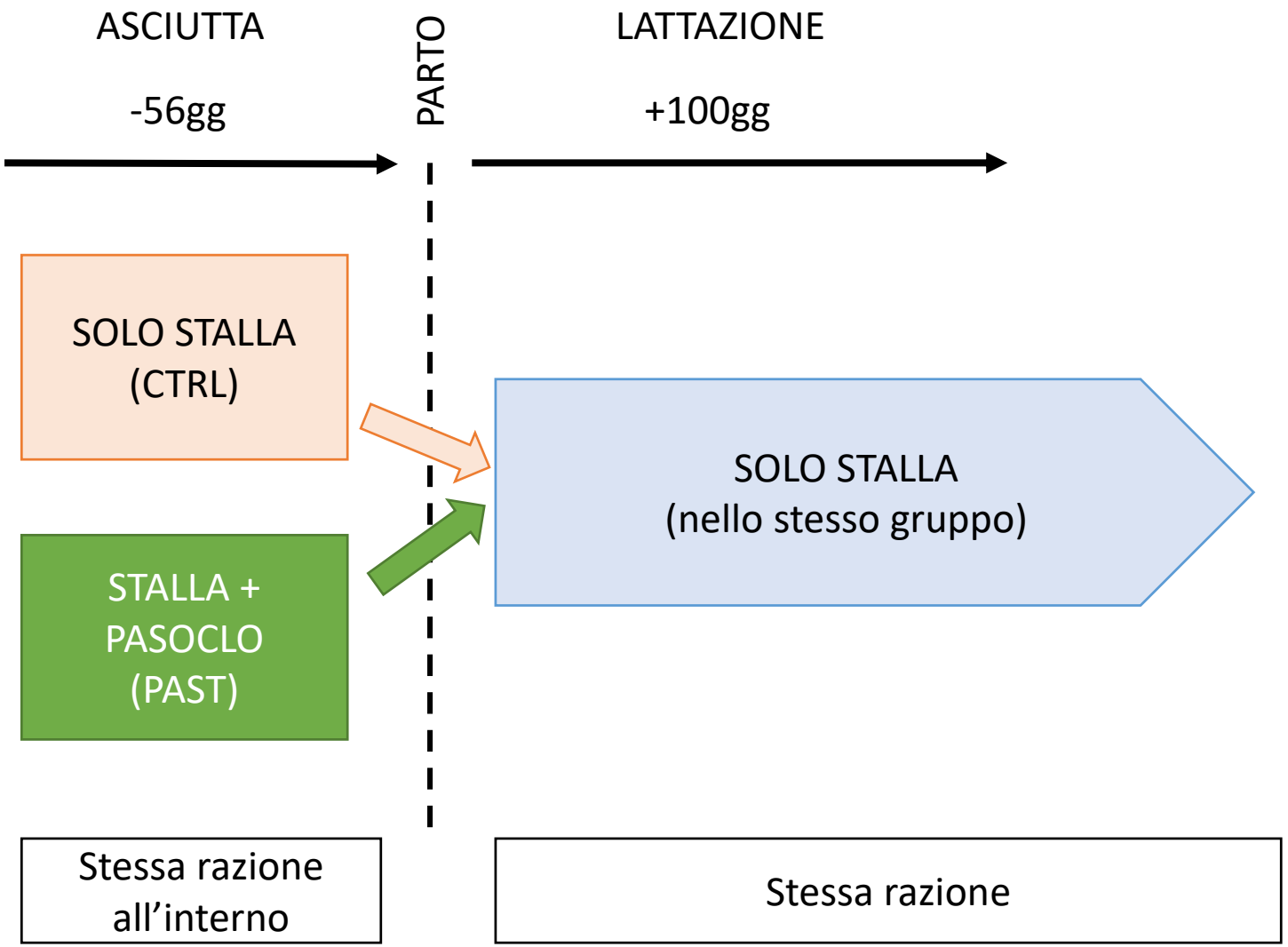
COS’È IL PASCOLO D’ESERCIZIO?

paddock

pascolo d’esercizio

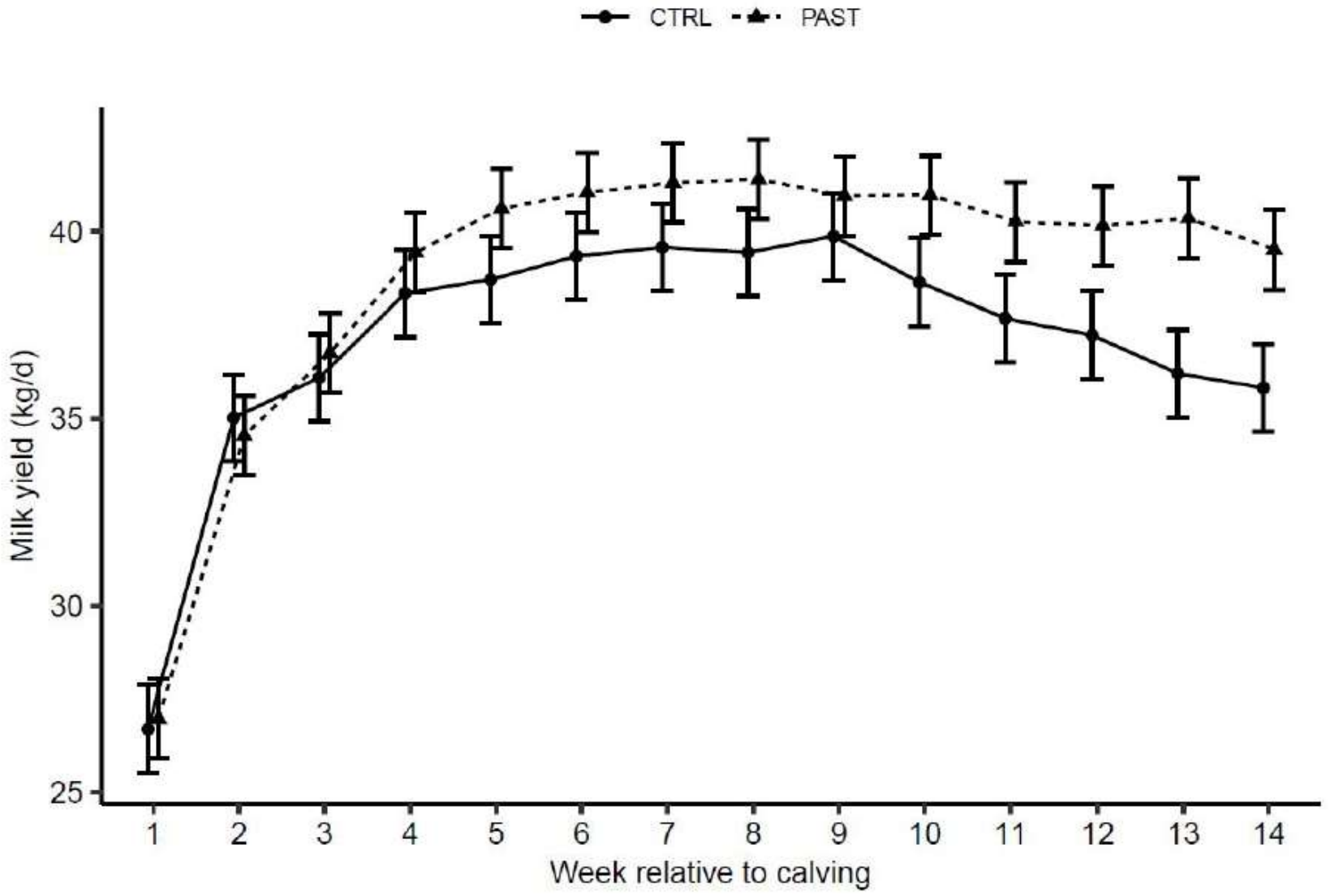
pascolo

LAYOUT OF THE EXPERIMENT



8 mesi
n. 87 vacche

RISULTATI: PRODUZIONE LATTE



+1.9 kg/gg
(0-100 DIM)

Leso et al., 2023.
J Dairy Sci.

RISULTATI: PRODUZIONE LATTE E COMPOSIZIONE

Item	CTRL	PAST
Milk yield (kg/cow*d)	37.0±1.12	38.9±1.04
305-d milk yield (kg)	9,276±268[a]	10,124±244[b]
Milk fat (%)	4.06±0.10	3.99±0.09
Milk protein (%)	3.20±0.03	3.22±0.03
SCC (1,000 cells/mL)	287±101	289±82

+848 kg/lact

Leso et al., 2023.
J Dairy Sci.

RISULTATI: PRODUZIONE LATTE E COMPOSIZIONE

305-d milk yield (kg)	9,276±268[a]	10,124±244[b]

+848 kg/lact

AZIENDA DI 100 VL

Introduzione pascolo d'esercizio per asciutte

(@ 0.60 €/L)

+60.900 €/anno

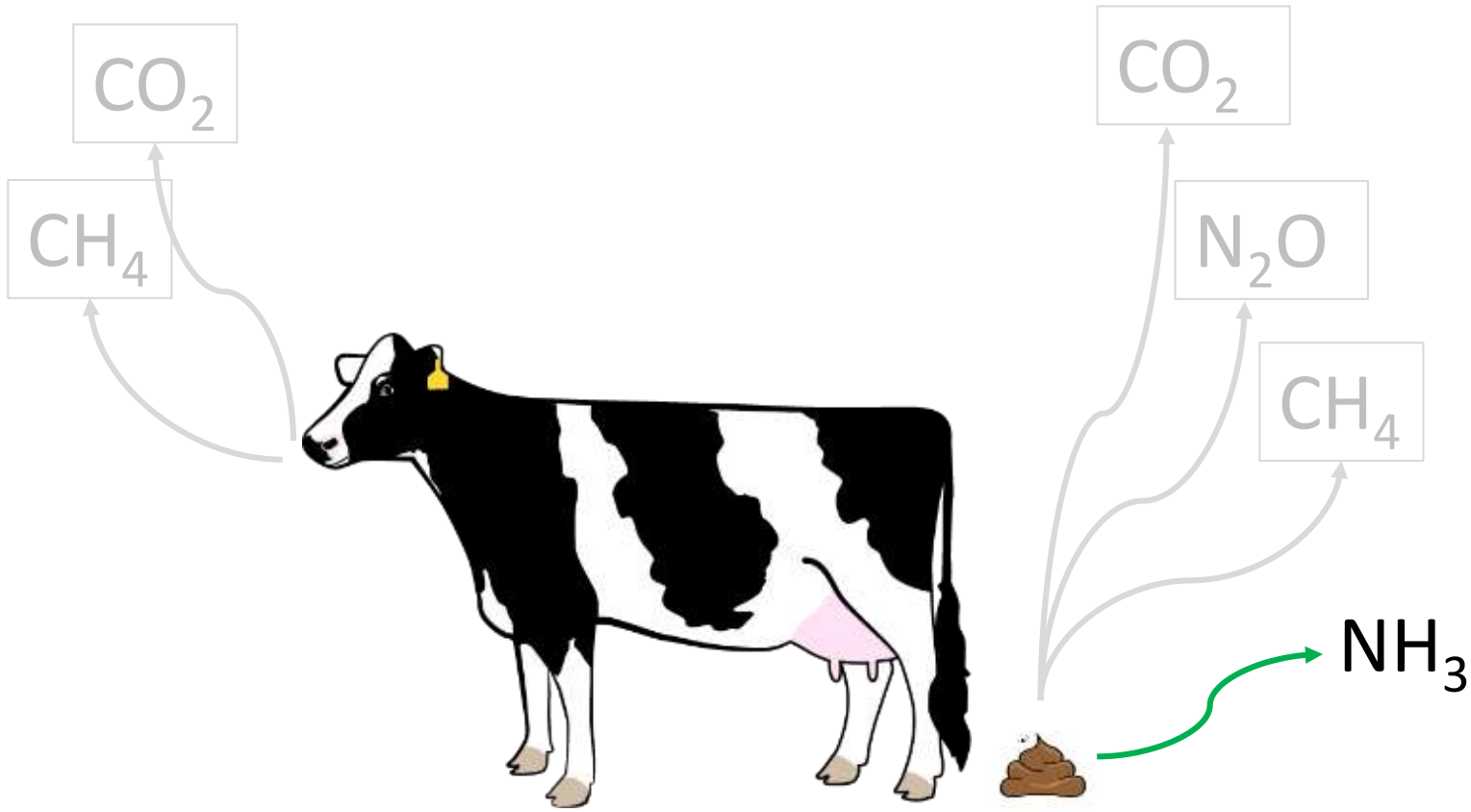
Leso et al., 2023.
J Dairy Sci.

SETUP PASCOLO D'ESERCIZIO

- È necessaria un'area relativamente ampia per **MANTENERE UNA COTICO VITALE**
  - **150-250 m² / vacca**
    - *più grande non è necessariamente migliore
  - **Almeno 2 paddock (rotazione 15-15 gg)**

- Esempio di PE per vacche in asciutta per un **ALLEVAMENTO DI 100 VACCHE IL LATTAZIONE**
  - Le vacche in asciutta sono il 15-20% delle vacche in lattazione 100 * 0,175 = 17.5 vacche in asciutta
  - **20 capi * 150-250 m² / vacca**

    = 3000-5000 m² (0.3-0.5 ha)


CO_2
CH_4
CO_2
N_2O
CH_4
NH_3

EFFETTI DELLE EMISSIONI GASSOSE DI AMMONIACA (NH_3)

L'agricoltura e la zootecnia producono l'87% delle emissioni di NH_3

IMPATTO SULLA SALUTE UMANA

NH_3 reagisce nell'atmosfera e forma particolato (PM2,5)

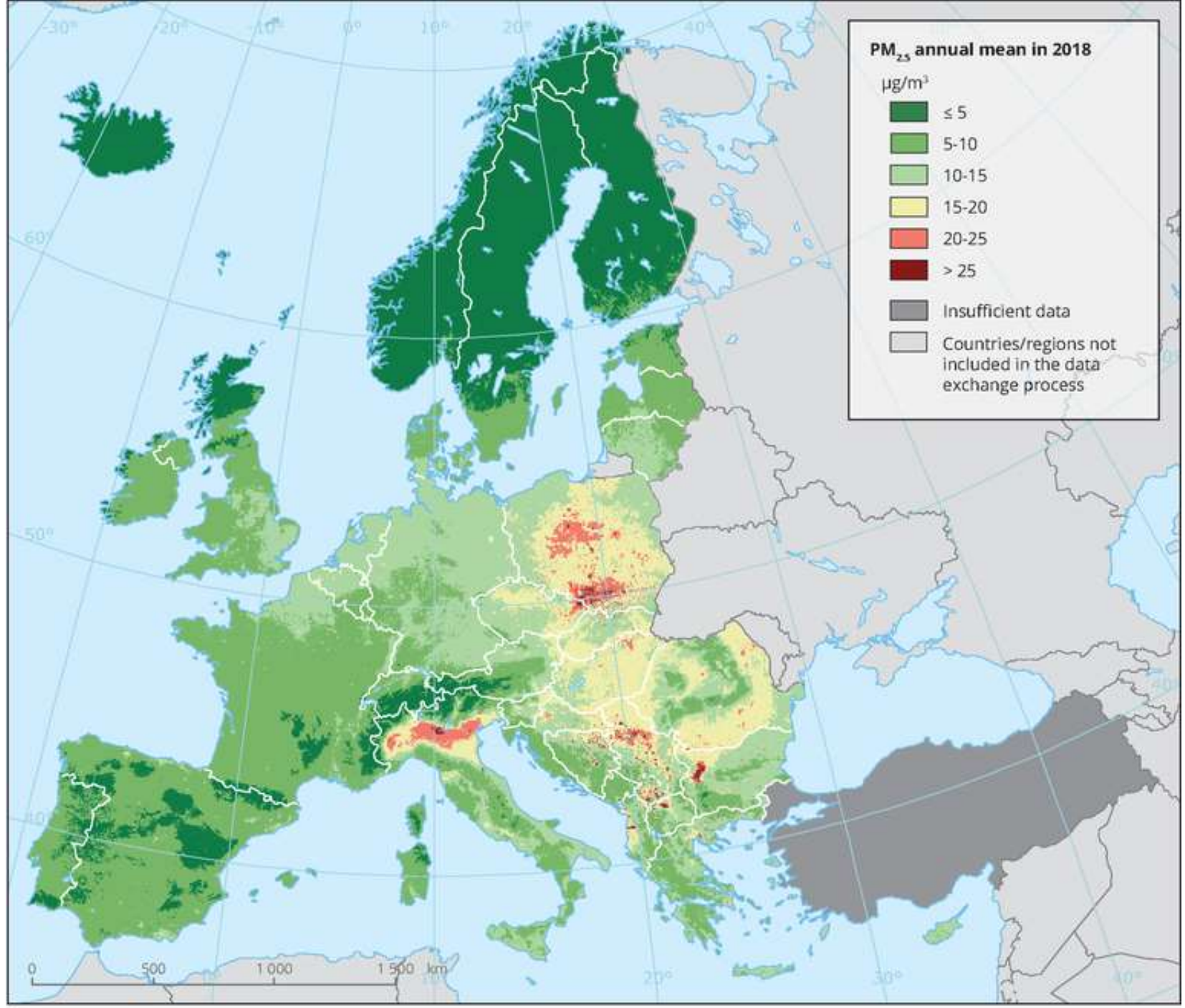
Il PM causa patologie respiratorie e cardiovascolari

NH_3 può trasferirsi su lunghe distanze, combinarsi con ossidi di azoto e formare smog nei centri abitati

IMPATTO SULL'AMBIENTE

ACIDIFICAZIONE DEL SUOLO

EUTROFIZZAZIONE



Reference data: ©ESRI | ©EuroGeographics

Agricultural Systems 216 (2024) 103898

Nitrogen loss abatement from dairy cow excreta through urine and faeces separation: The effect of temperature and exposure period on NH_3 fluxes

Valentina Becciolini [a], Lorenzo Leso [a], Esperanza Fuertes Gimeno [b], Giuseppe Rossi [a], Matteo Barbari [a], Anna Dalla Marta [a], Simone Orlandini [a], Leonardo Verdi [a,*]

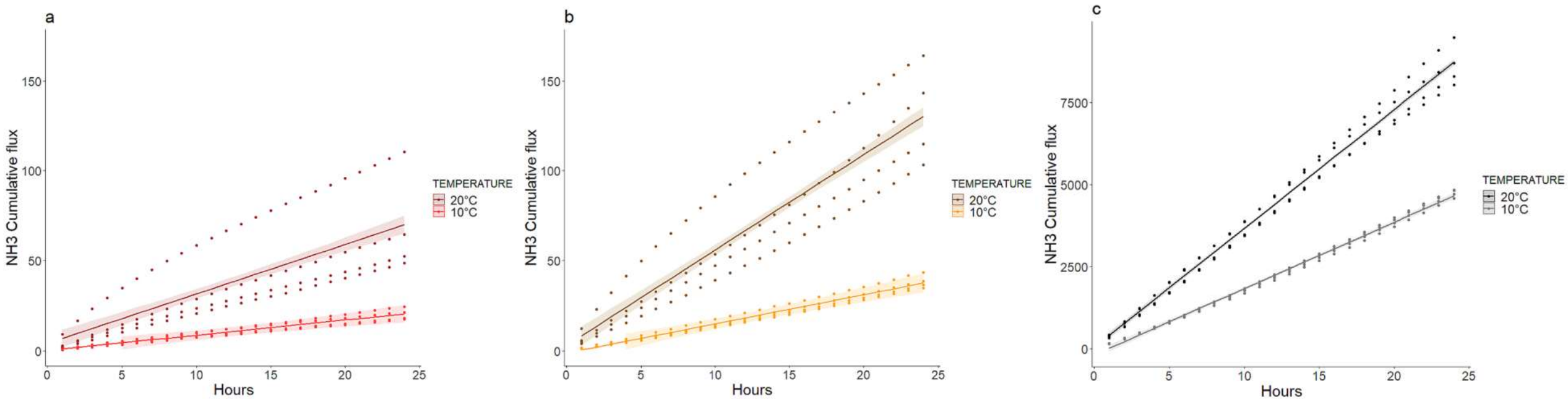
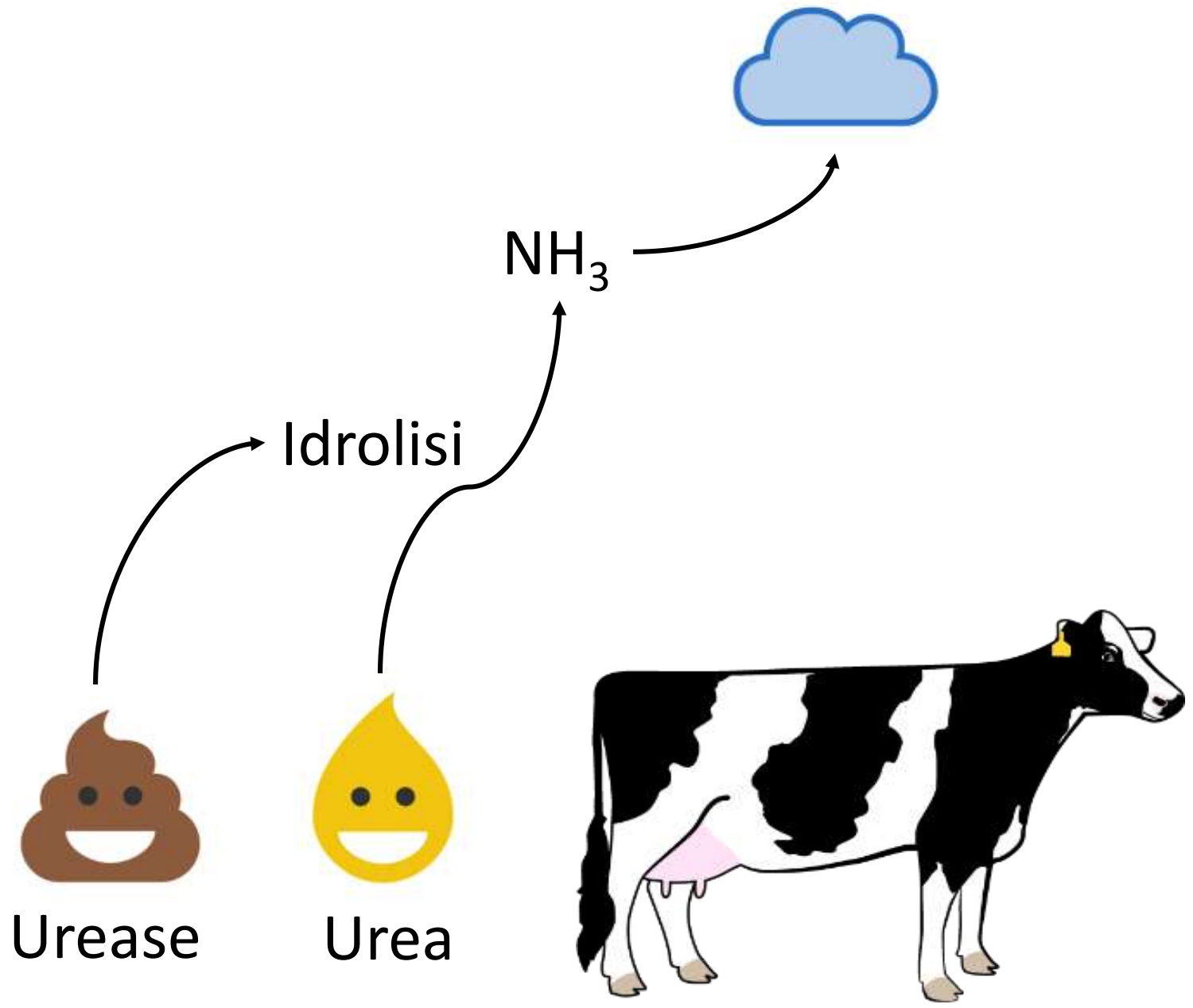


Fig. 4. Regression lines for NH_3 cumulative fluxes (mg · m-2) with 95% confidence intervals in the two environmental treatments (10 °C and 20 °C) over exposure time (hours). Original data points are depicted as points. a: faeces, b: urine, c: mix.


NH_3
Idrolisi
Urease
Urea

MATERIALI E METODI

- **URINA E FECI RACCOLTE SEPARATAMENTE**
  - Campioni presi da 10 vacche in lattazione (alim. GP)
  - Composite samples
  - Evitato contatto tra i due materiali
  - Campioni congelati immediatamente dopo raccolta

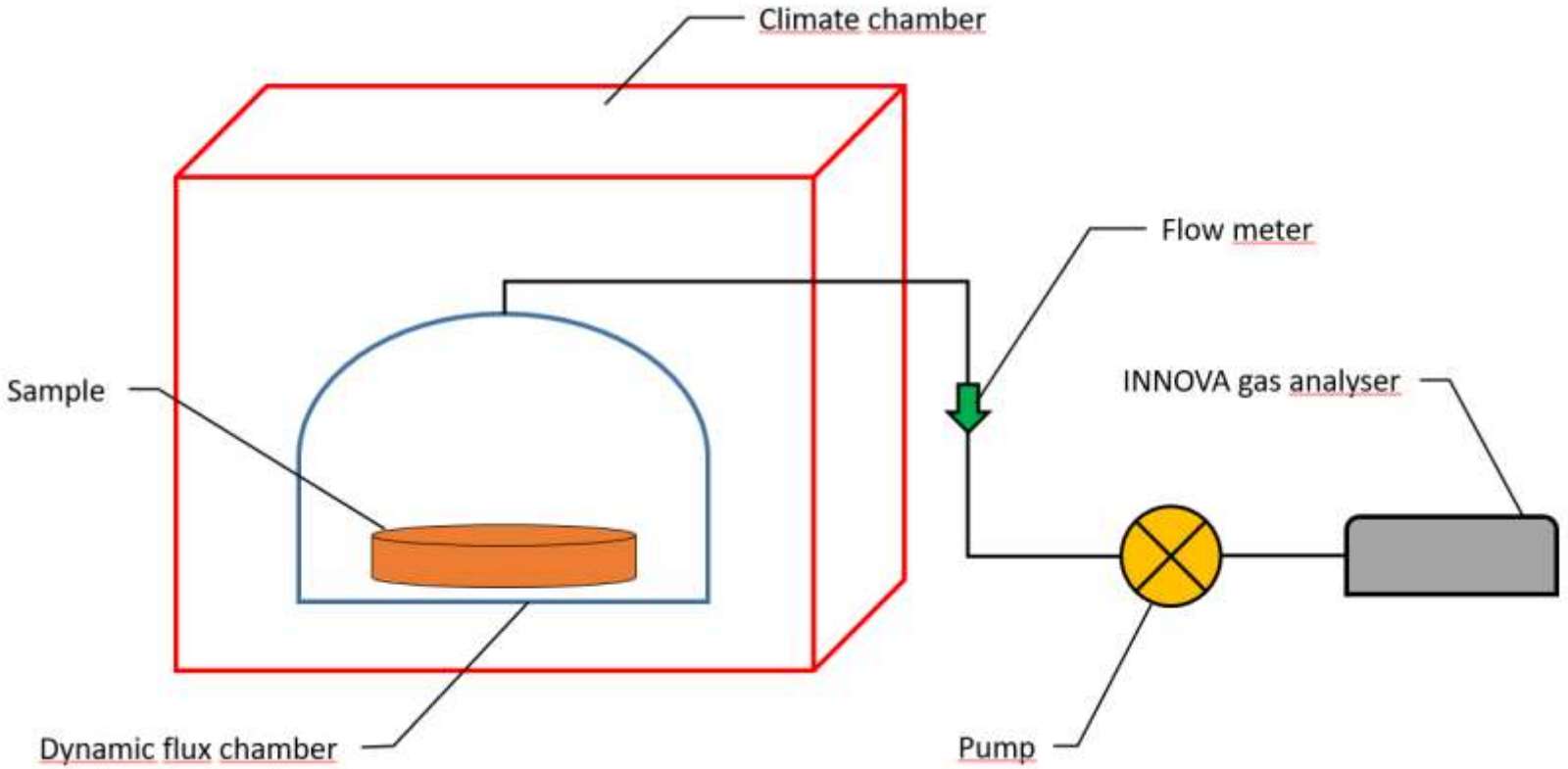
- **CREATI TRE SUBSTRATI PER I TEST**
  - URINA (100%)
  - FECI (100%)
  - MIX (50% URINA: 50% FECI)

- **TEST IN CAMERA CLIMATICA PER 24h (3*3*72h)**
  - **Dynamic flux chamber**

- **MISURAZIONE IN CONTINUO DELLE CONCENTRAZIONI DI GAS**
  - Innova® 1314i photoacoustic gas monitor
  - NH3, N_2O, CH_4, CO_2, H_2O

- **IN TOTALE TESTATI 72 CAMPIONI DI ~500G**
  - 4 repliche

MATERIALI E METODI



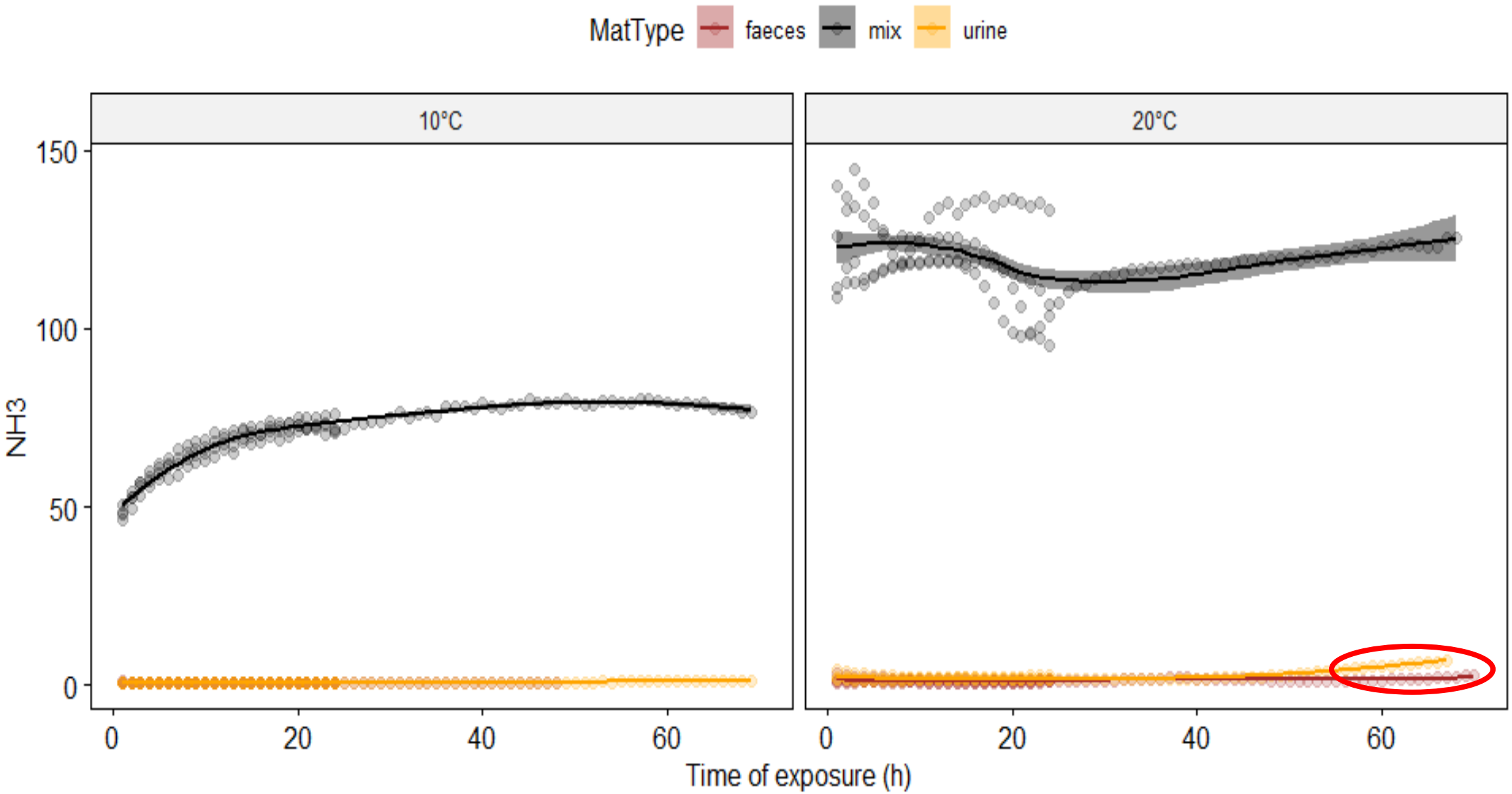
RISULTATI (PRELIMINARI)

Table 1. Least squares means (LSM) and standard error (SE) of gaseous emissions for different gaseous species produced by type of material × air temperature interaction.

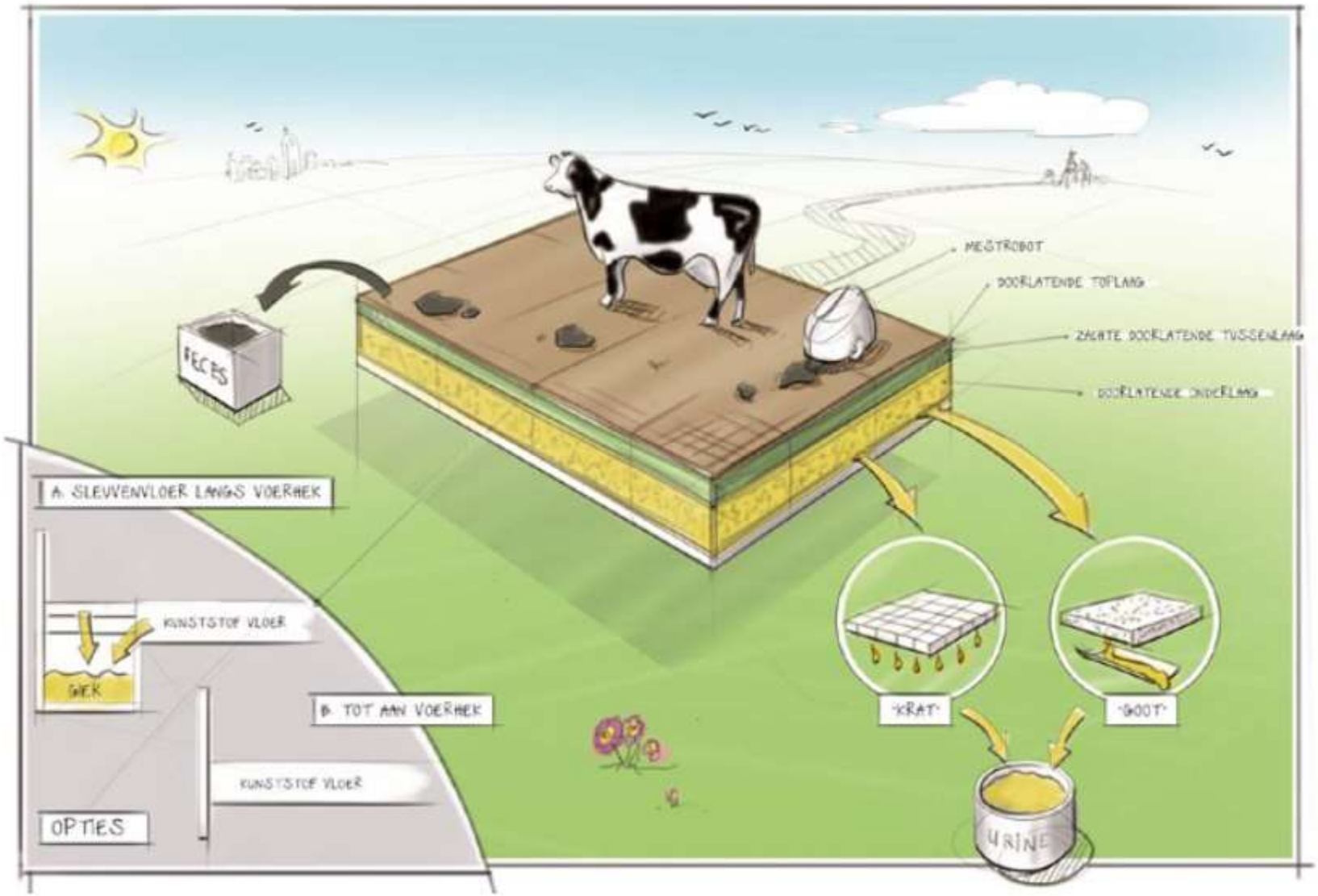
		Type of material					
		Faeces		Mix		Urine	
Gaseous species	Air temperature	LSM	SE	LSM	SE	LSM	SE
NH_3	10°C	0.57^{a}	1.59	$62.60^{x,b}$	1.77	0.71^{a}	1.77
	20°C	1.26^{a}	1.77	$122.38^{y,b}$	1.77	1.98^{a}	1.77
N_2O	10°C	$1.15^{ab,x}$	0.015	1.20^{a}	0.016	$1.09^{b,x}$	0.016
	20°C	$1.09^{a,y}$	0.015	1.14^{b}	0.016	$1.03^{a,y}$	0.016
CH_4	10°C	8.39^{x}	0.86	7.78	0.97	5.22^{x}	0.97
	20°C	$11.79^{a,y}$	0.97	10.81^{a}	0.97	$7.32^{b,y}$	0.97
CO_2	10°C	790^{a}	35.9	$1254^{b,x}$	40.2	$1124^{b,x}$	40.2
	20°C	753^{a}	40.2	$1103^{b,y}$	40.2	$812^{b,y}$	40.2
H_2O	10°C	8409^{x}	114	8522^{x}	128	8331^{x}	128
	20°C	14812^{y}	128	14673^{y}	128	14730^{y}	128

^{a,b}Significant differences among columns (type of material) within air temperature ($P < 0.05$).

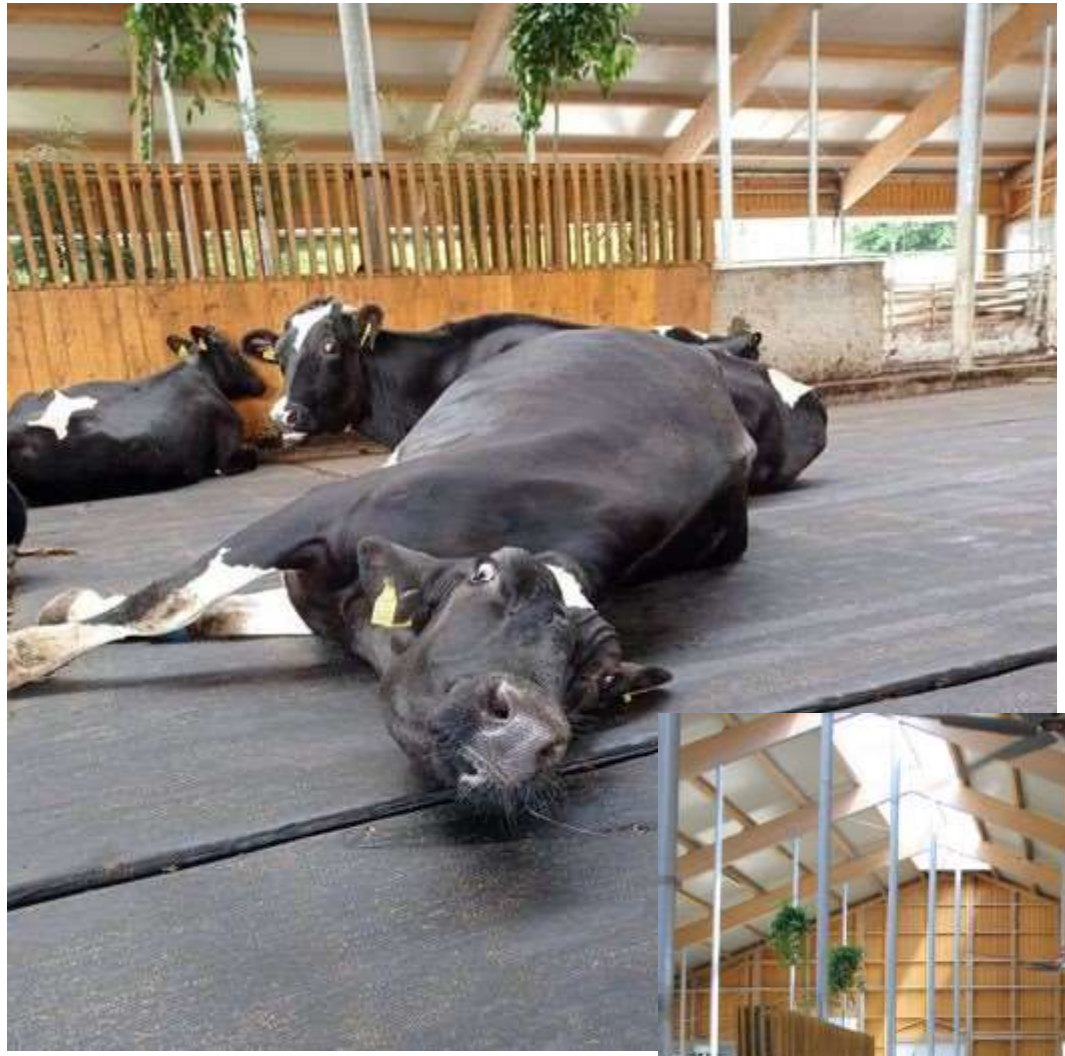
^{x,y}Significant differences among rows (air temperature) within type of material ($P < 0.05$).


MatType
faeces
mix
urine
10°C
20°C
150
100
50
0
NH3
0
20
40
60
Time of exposure (h)

OK, MA COME SEPARARE FECI E URINE IN STALLA?

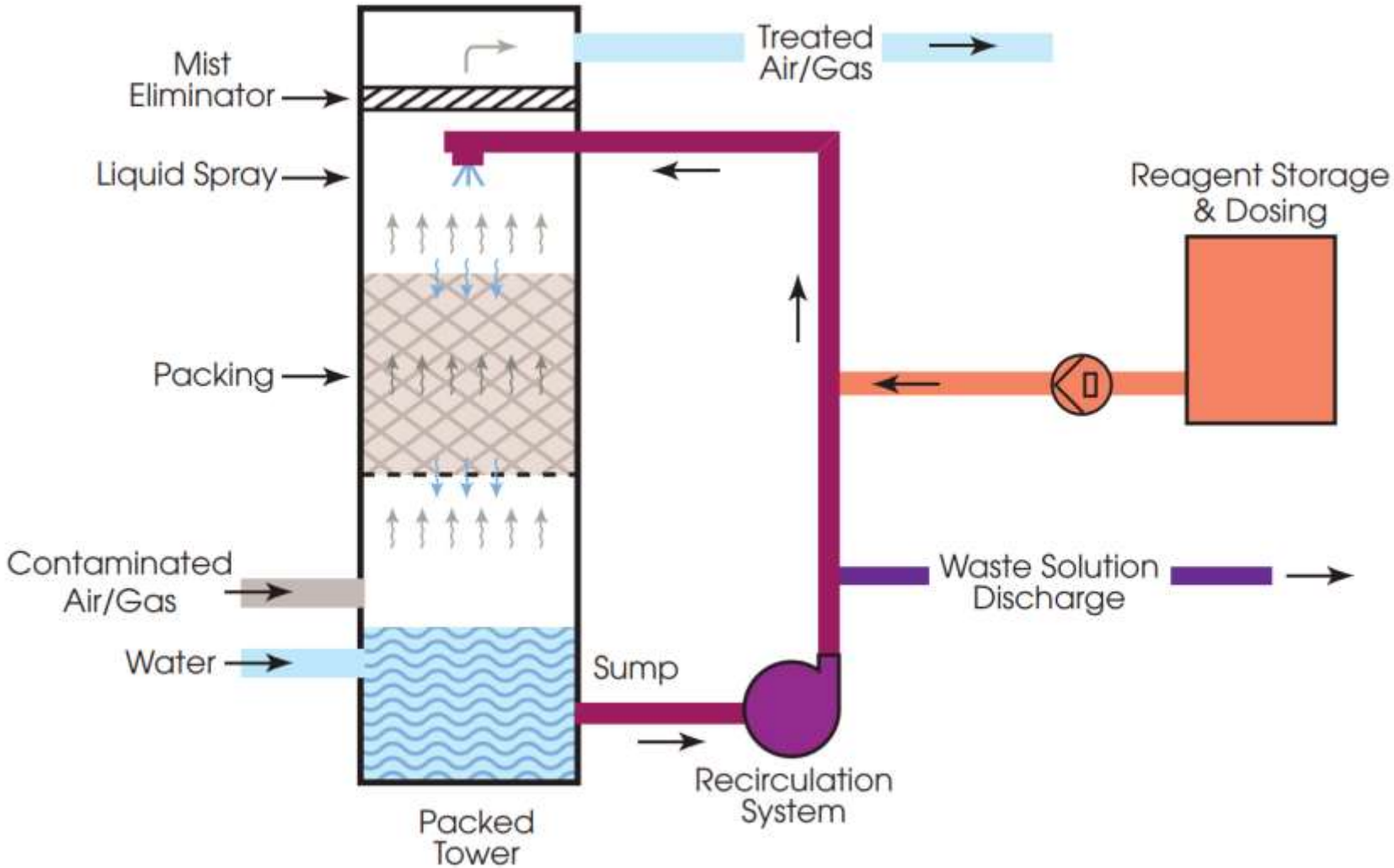


HIGH WELFARE FLOOR



COW TOILET

OK, UNA VOLTA CHE ABBIAMO SEPARATO L'URINA, COSA CI FACCIAMO?




Lely Discovery
120 Collector


Lely Sphere