Benessere Animale LivingLab

AKIS

ERSAF ENTE REGIONALE PER I SERVIZI ALL'AGRICOLTURA E ALLE FORESTE

UNIVERSITÀ CATTOLICA del Sacro Cuore

Gestione delle lettiere e rischio di infezioni mammarie

Paolo Moroni

24 Ottobre Gambara

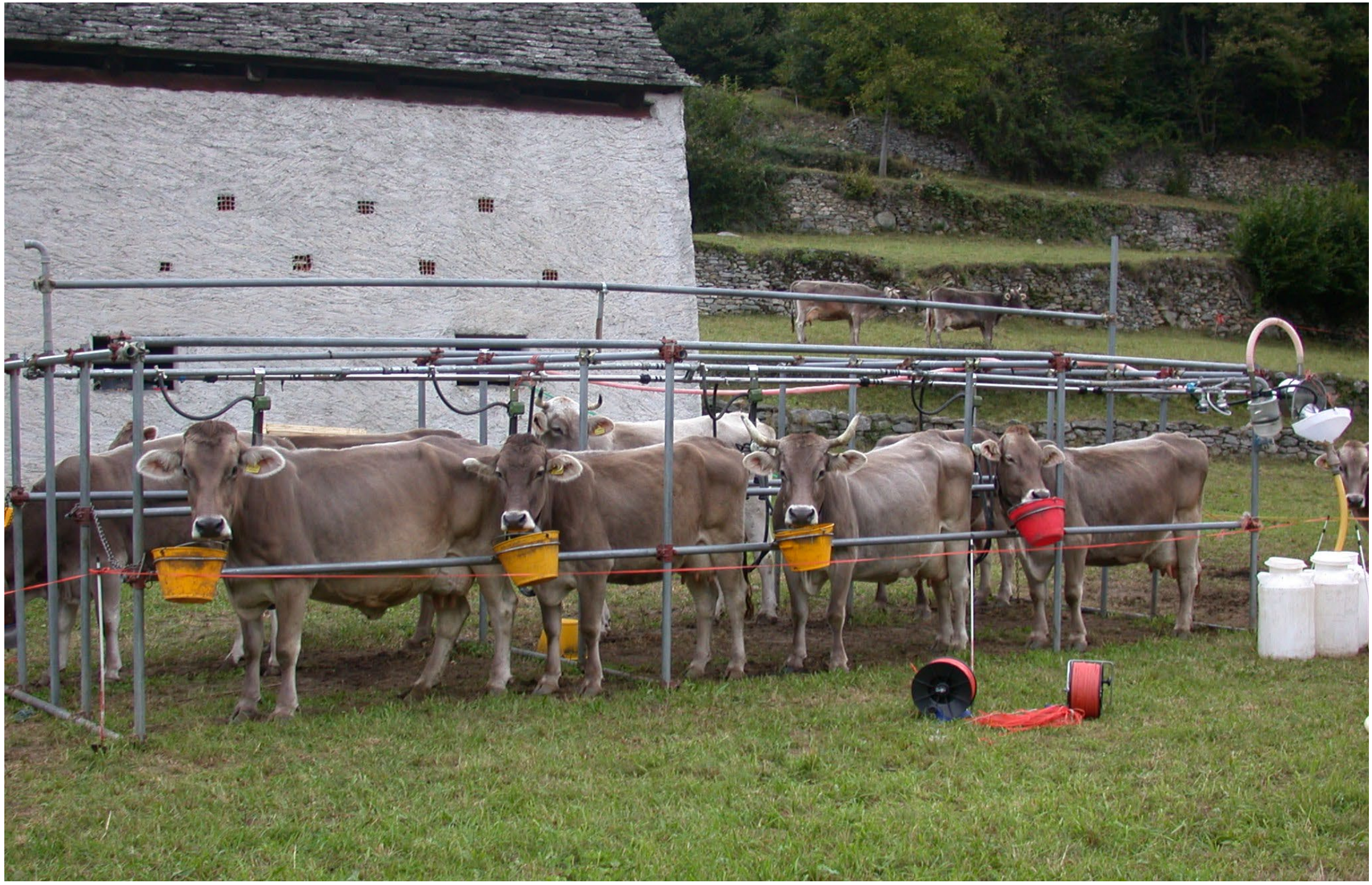
divas DIPARTIMENTO DI MEDICINA VETERINARIA E SCIENZE ANIMALI

MiLab Laboratorio di Malattie Infettive degli Animali - Università degli Studi di Milano -

Un ringraziamento

- Sara Fusar Poli
- Valentina Monistero
- Sara Deppieri
- Gustavo Freu
- Delower Hossain

- Nicola Rota (Agribovis)




US

In che direzioni stiamo andando?

Riduzione utilizzo antibiotici
Aumento uso sigillanti interni

Batteriologia
PCR
On farm culture

Aumento dati prodotti ed archiviati
Cambiamento management
Gestione delle lettiere

Vaccinazione
Prodotti omeopatici e simili

Epidemiologia mastiti cliniche

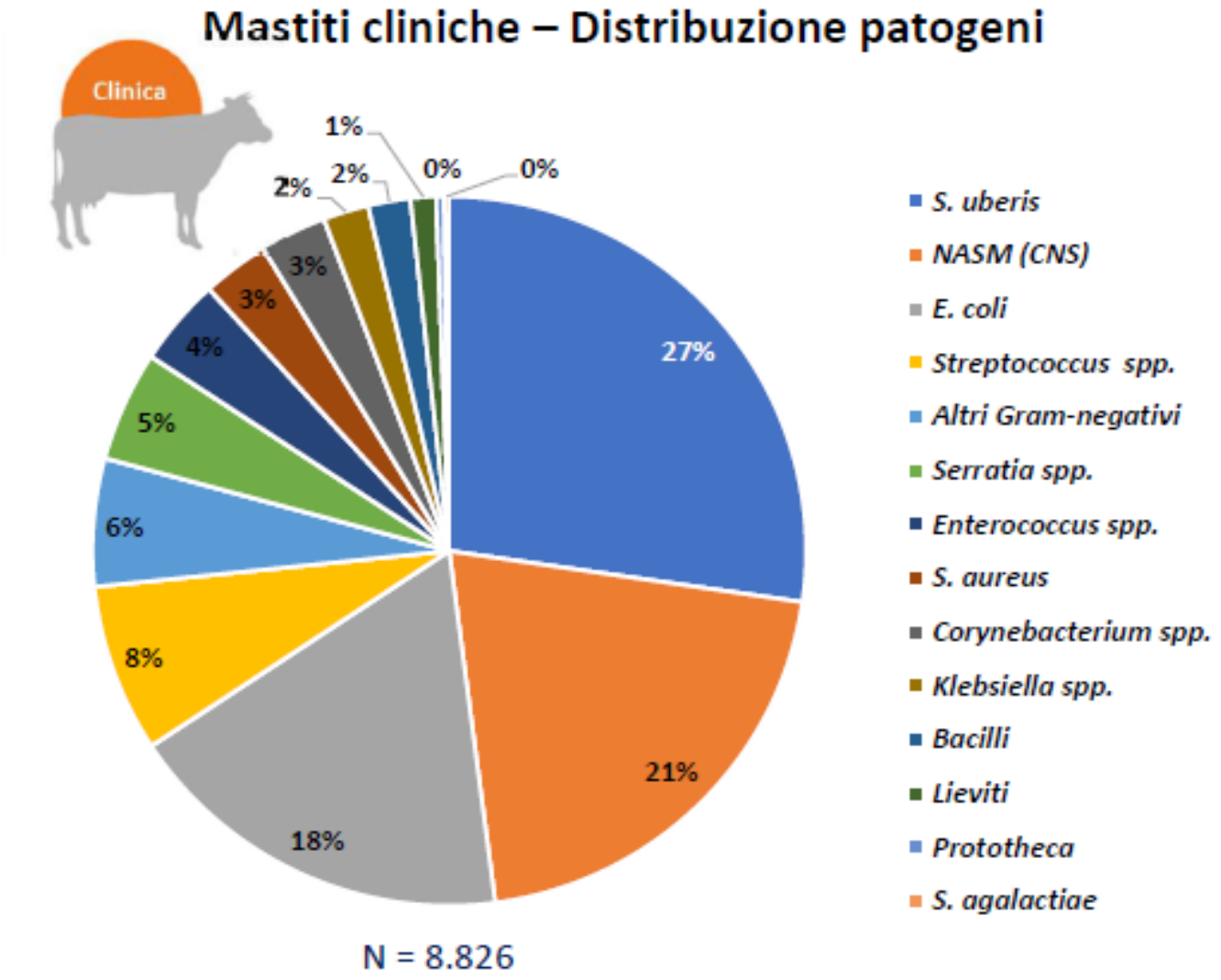
Typical distribution of pathogens causing clinical mastitis in modern dairy herds from selected studies

Table 3
Distribution of pathogens causing clinical mastitis from recent North American studies

Study	Sample Size	*Strep ag* or *Staph aureus* (%)	Non–*aureus Staph* (%)	Env Strep (%)	Coliform (%)	Other (%)	No Growth (%)
Vasquez et al,[23] 2017	489 cases in 1 herd	0	2	32	34	2	30
Vasquez et al,[24] 2016	596 cases in 6 herds	7	2	20	19	19	33
Lago et al,[25] 2016	223 cases in 1 herd	0	12	22	7	3	56
Tovar et al,[26] 2016	473 cases in 1 herd	0	19	30	10	4	37
Oliveira et al,[27] 2013	741 cases in 50 herds	3	6	13	37	14	27
Schukken et al,[28] 2013	296 cases in 7 herds	3	3	29	24	14	28
MacDonald,[29] 2011	675 cases in 48 herds	14	5	21	9	23	28
Lago et al,[30] 2011	449 cases in 8 herds	7	9	14	24	12	34
Pinzón-Sánchez and Ruegg,[31] 2011	143 cases in 4 herds	1	3	18	30	6	42
Bar et al,[32] 2007	2965 cases in 5 herds	5	3	21	40	10	21
Olde Riekerink et al,[33] 2008	2850 cases in 106 herds	11	6	16	14	7	46
Hoe and Ruegg,[34] 2005	217 cases in 4 herds	0	14	24	25	8	29

Lago and Godden 2018

Mastiti cliniche solo patogeni
UNIMI 2021-2023



Addis F., 2024

J. Dairy Sci. 102:10213–10234
https://doi.org/10.3168/jds.2019-16692

Relationships among bedding materials, bedding bacteria counts, udder hygiene, milk quality, and udder health in US dairy herds

K. Patel,[1] S. M. Godden,[1]* E. Royster,[1] B. A. Crooker,[2] J. Timmerman,[1] and L. Fox[3]
[1]Department of Veterinary Population Medicine, University of Minnesota, Saint Paul 55108
[2]Department of Animal Science, University of Minnesota, Saint Paul 55108
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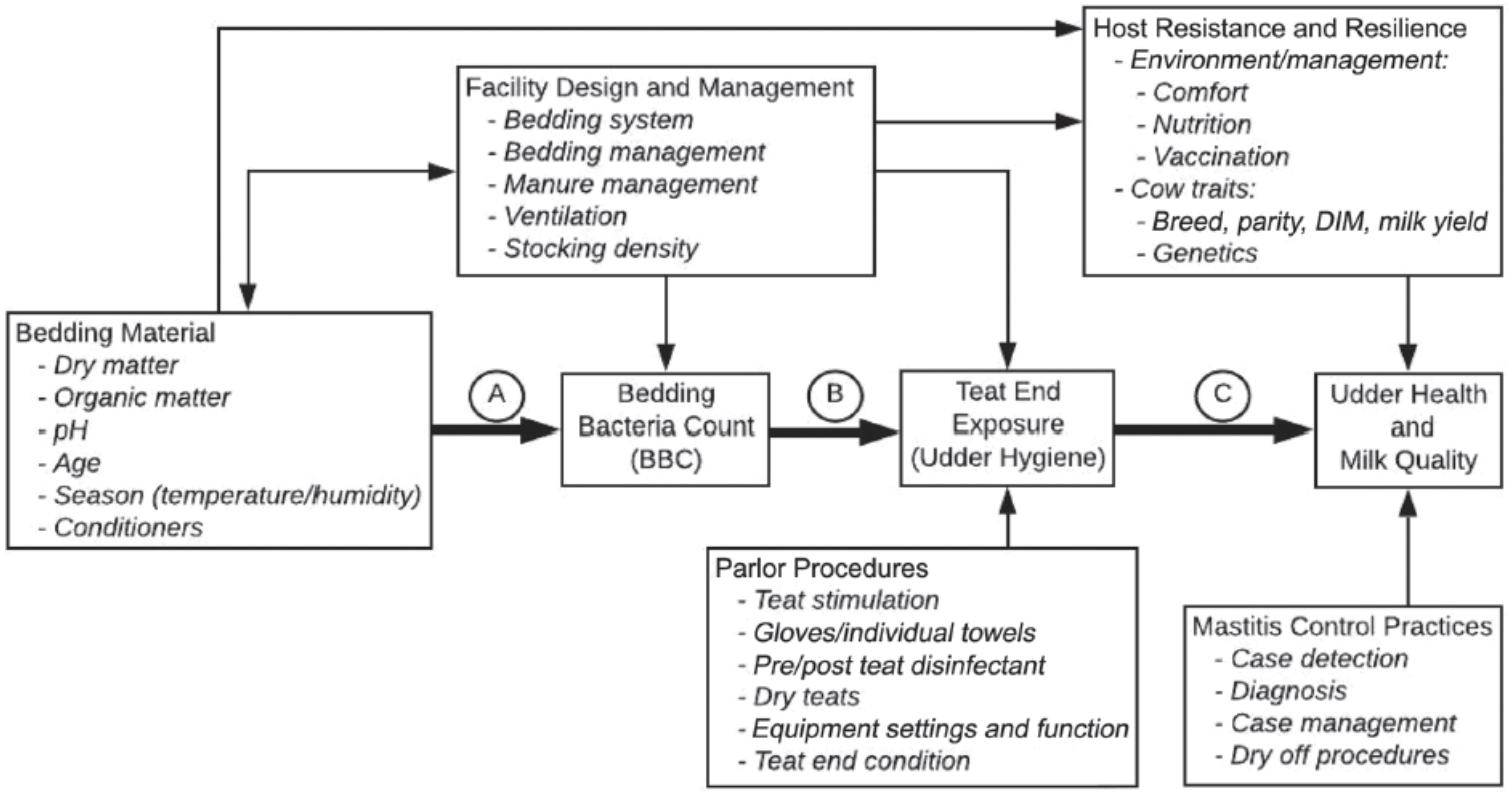


Figure 1. Suggested causal pathway describing major risk factors for environmental mastitis. Heavy arrows (lines A, B, and C) depict major relationships of interest in this study.

Lettiere

- Economiche
- Asciutte
- Confortevoli
- Non devono dare la possibilita’ ai batteri di moltiplicarsi
- Devono essere compatibili con le strutture aziendali

Organic

MANURE SOLIDS

STRAW

WOOD SHAVINGS

Inorganic

SAND

RECYCLED SAND

Materassi un falso mito?

Materassi

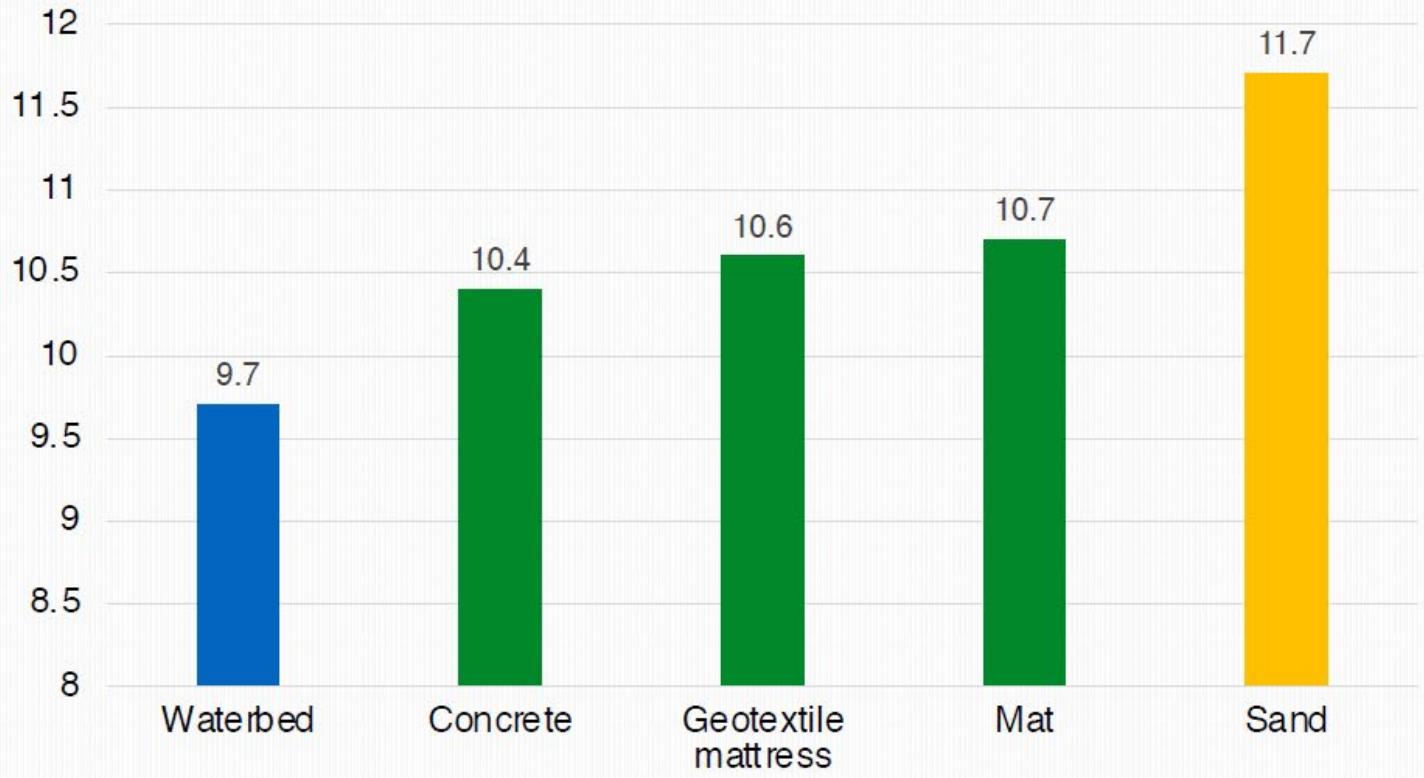
Cook 2007

Materassi

Materassi ad acqua

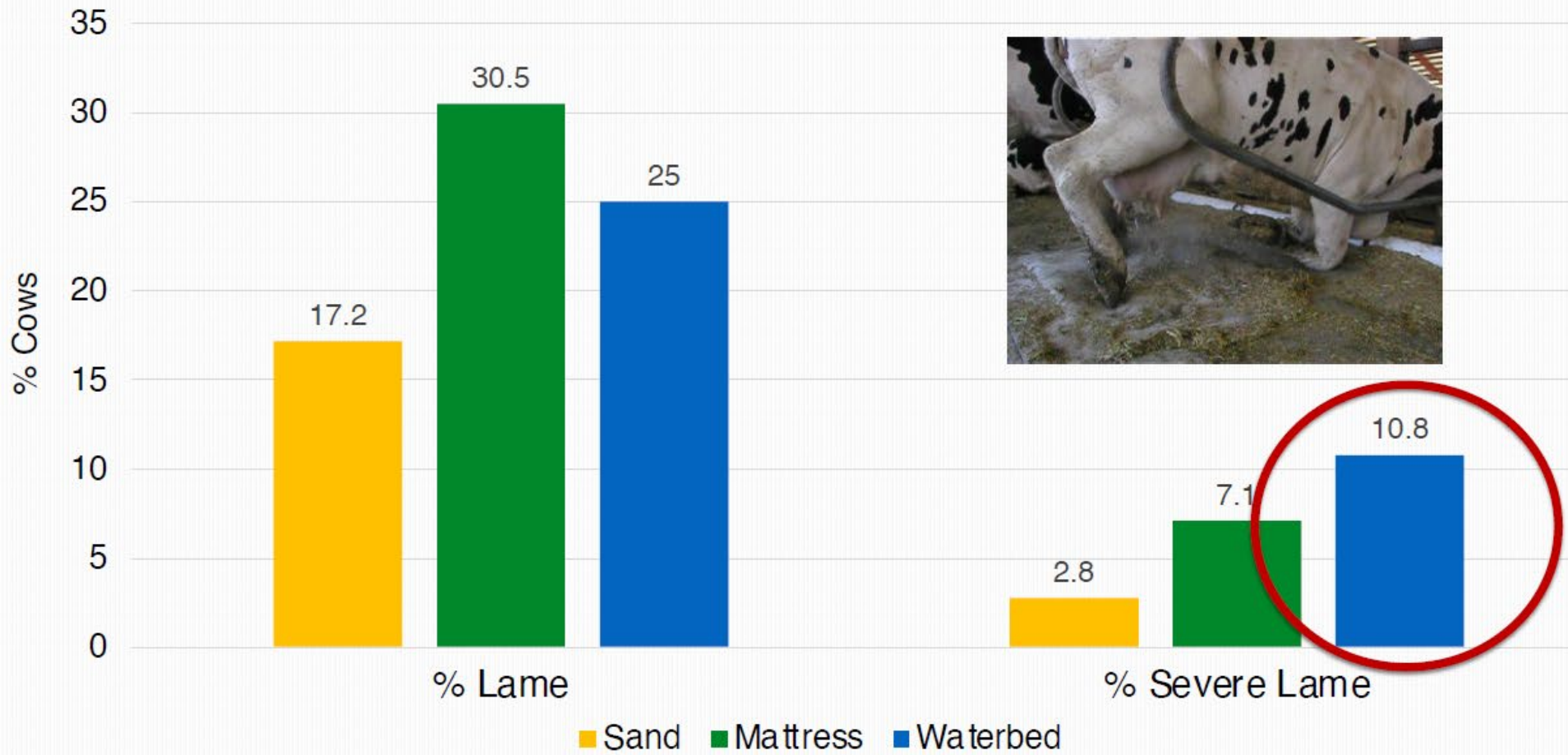
Bed Surfaces and Lying Time

(Solano et al., JDS 99:2086,2016; 141 farms in Alberta, Ontario and Quebec)



Cook, 2021

Impact of Stall Base on Lameness in AMS Units



Salfer et al., JDS 101:8586-8594, 2018 from 54 AMS units in Upper Midwest

Cook, 2021

Materassi

- Abrasioni al garretto
  - Igroma

Proudfoot, PDPW, 2016

Paglia

Observational study of temperature, moisture, pH and bacteria in straw bedding, and faecal consistency, cleanliness and mastitis in cows in four dairy herds

W. R. WARD, J. W. HUGHES, W. B. FAULL, P. J. CRIPPS, J. P. SUTHERLAND, J. E. SUTHERST

The **Veterinary Record**, August 17, 2002

Journal of Dairy Research (1982), **49**, 369–373 *Printed in Great Britain*

Sources of *Streptococcus uberis* in the dairy herd

I. Isolation from bovine faeces and from straw bedding of cattle

By A. JOHN BRAMLEY
National Institute for Research in Dairying, Shinfield, Reading RG2 9AT, UK

(*Received 17 December 1981 and accepted for publication 12 February 1982*)

Summary. During an outbreak of mastitis due to *Streptococcus uberis* the organism was frequently isolated from samples of straw bedding used by the cattle. More than one million *Str. uberis*/g straw were isolated from 36% of samples. The organism was also recovered from 34% of samples of bovine faeces, but usually in low numbers. An examination of straw samples collected from cattle yards on 32 other dairy farms demonstrated that this was not an isolated occurrence since *Str. uberis* was found in 24% of samples from 56% of the herds. No correlation was found between counts of *Str. uberis* and coliforms. The significance of these observations is discussed.

Separato

La diffusione del trattamento di separazione meccanica del liquame in molti allevamenti bovini da latte di medie e grandi dimensioni ha portato a considerare la possibilità di utilizzare la frazione solida ottenuta (separato) sia come ammendante,sia come materiale da lettiera per le vacche da latte in stabulazione libera a cuccette

Ferrari e Pretera 2009


Separator


GEA


GEA

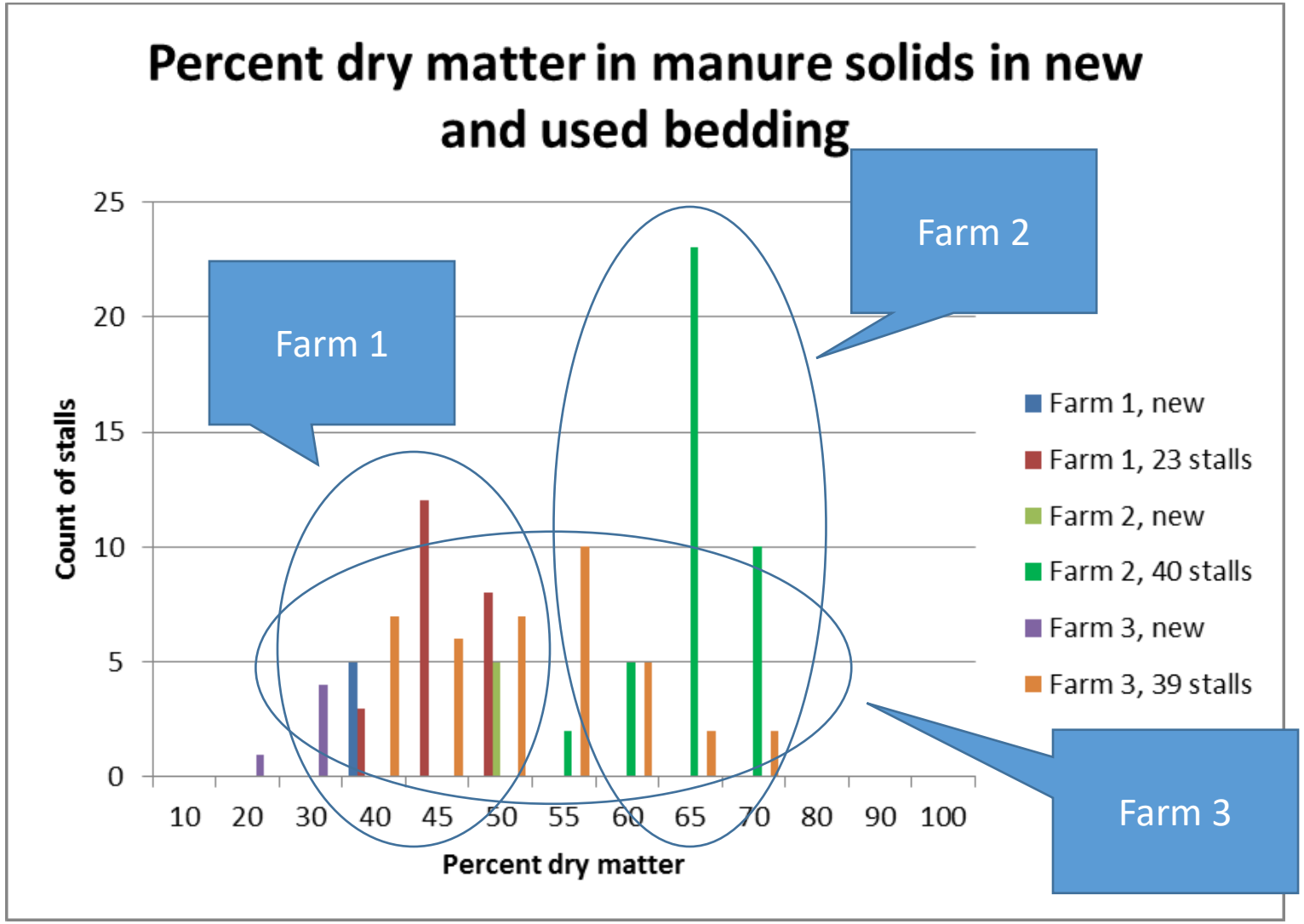

JHminiStrø

Carica batterica totale nel separato

Management Step	Used bedding in Farm A pathogen count (CFU/g; ±Standard Error)		
	Gram Positive Organisms		Gram negative organisms
	Streptococcus species	Staphylococcal species	Coliforms
Pre	181 million (±39 m)	6.5 million (±1.8 m)	12.1 million (±1.9 m)
mescolato	284 million (±63 m)	25 million (±9.5 m)	9.5 million (±2.6 m)
Con calce	29,823 (±27,014)	2,484 (±1,401)	1 (±0)

Lacalce ferma la crescita dei batteri ?… ma per quanto?

Variabilita’ nei campioni…



A seconda del prodotto.....

Campioni consegnati 02/02/2021

Identificazione Campione	Umidità %	pH
Separato semplice	66,54	9,60
Separato con CaCO3	44,61	9,59
Separato con VF10	33,19	12,66

Leso L., dati personali 2021

Benchmarks per batteri presenti nelle lettiere

cfu/cc wet bedding)

NS: New Sand / RS: Reclaimed Sand / ON: Organic non-manure / MS: Manure Solids

Unused Bedding

Bacteria Group	Bedding Type	Low	Moderate	High
Staph spp.	NS / RS / ON / MS	0	.	>0
Klebsiella spp.	NS / RS / ON / MS	0	.	>0
Coliforms	NS / RS / ON / MS	≤ 500	.	>500
SSLO (*Strep* spp.)	NS / RS / ON	0	1 – 1,000	>1,000
	MS	≤ 1,000	1,000 – 750,000	>750,000

Used Bedding

Bacteria Group	Bedding Type	Low	Moderate	High
Staph spp.	NS / RS / ON / MS	0	.	>0
Klebsiella spp.	NS / RS / ON / MS	0	.	>0
Coliforms	NS / RS / ON	≤ 10,000	.	>10,000
	MS	≤ 10,000	10,001 – 200,000	>200,000
SSLO (*Strep*. Spp.)	NS / RS / ON / MS	≤ 500,000	500,001 – 2,000,000	>2,000,000

Godden S., Rome 2021

Campione	Data Campionamento	Data Analisi	Peso Campione Fresco (g)	Peso Campione Secco (g)	Sostanza Secca (%)	pH
-	07/10/2024	08/10/2024	10,15	2,34	23,1	8,77

Campione	Data Campionamento	Data Analisi	Peso Campione Fresco (g)	Peso Campione Secco (g)	Sostanza Secca (%)	pH
FRESCO	07/10/2024	08/10/2024	9,97	2,57	25,8	8,62
MISCELATO NUOVO	07/10/2024	08/10/2024	10,35	3,22	31,1	8,56
VECCHIO	07/10/2024	08/10/2024	9,90	6,50	65,7	8,43
LETTIERA ASCIUTTA	07/10/2024	08/10/2024	10,10	4,00	39,6	8,34

Campione	Data	Data Analisi	Peso Campione Fresco (g)	Peso Campione Secco (g)	Sostanza Secca (%)	pH
Separato per cuccette	25/11/2024	27/11/2024	9,73	2,98	30,6	8,52
Separato Normale	25/11/2024	27/11/2024	10,23	2,92	28,5	8,19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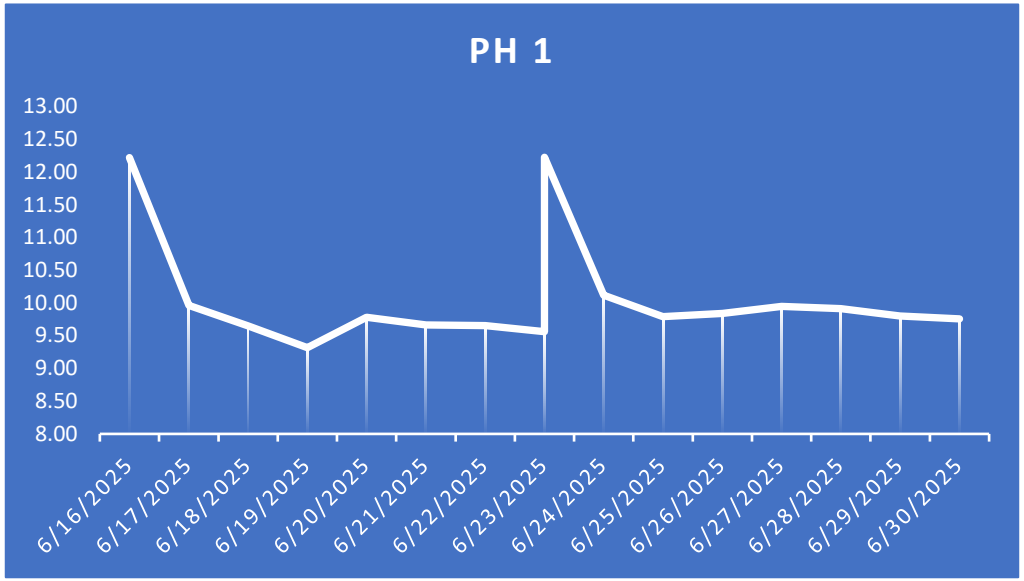
MALTA
FINA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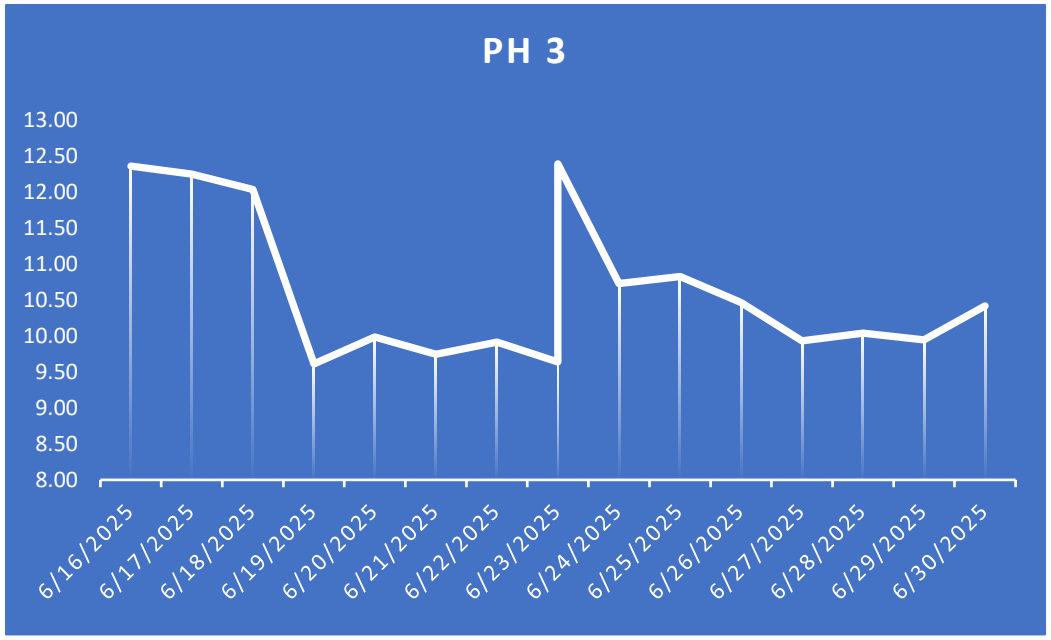
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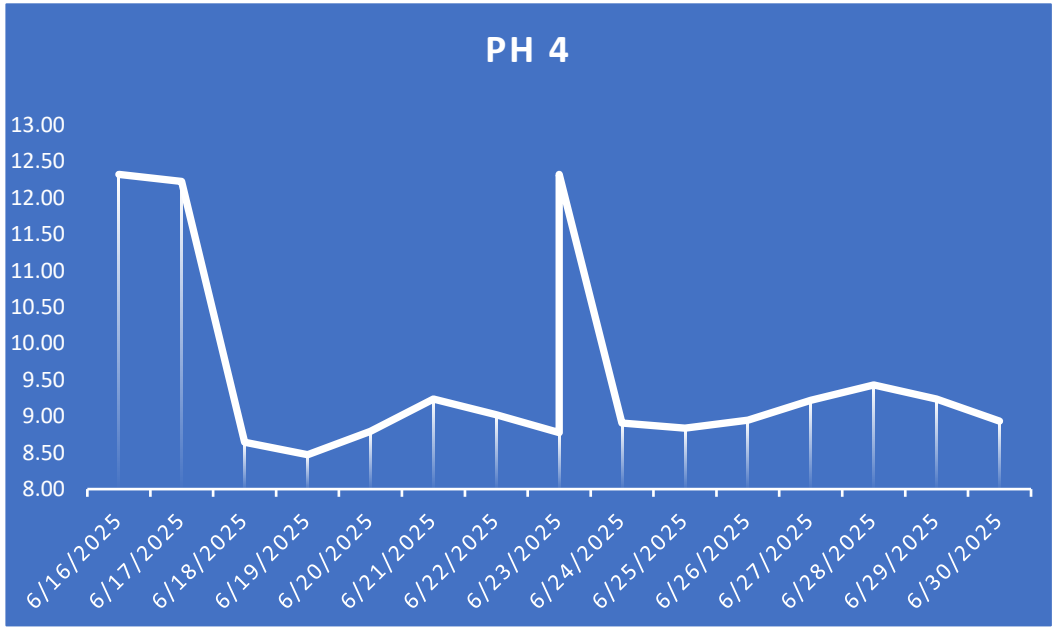
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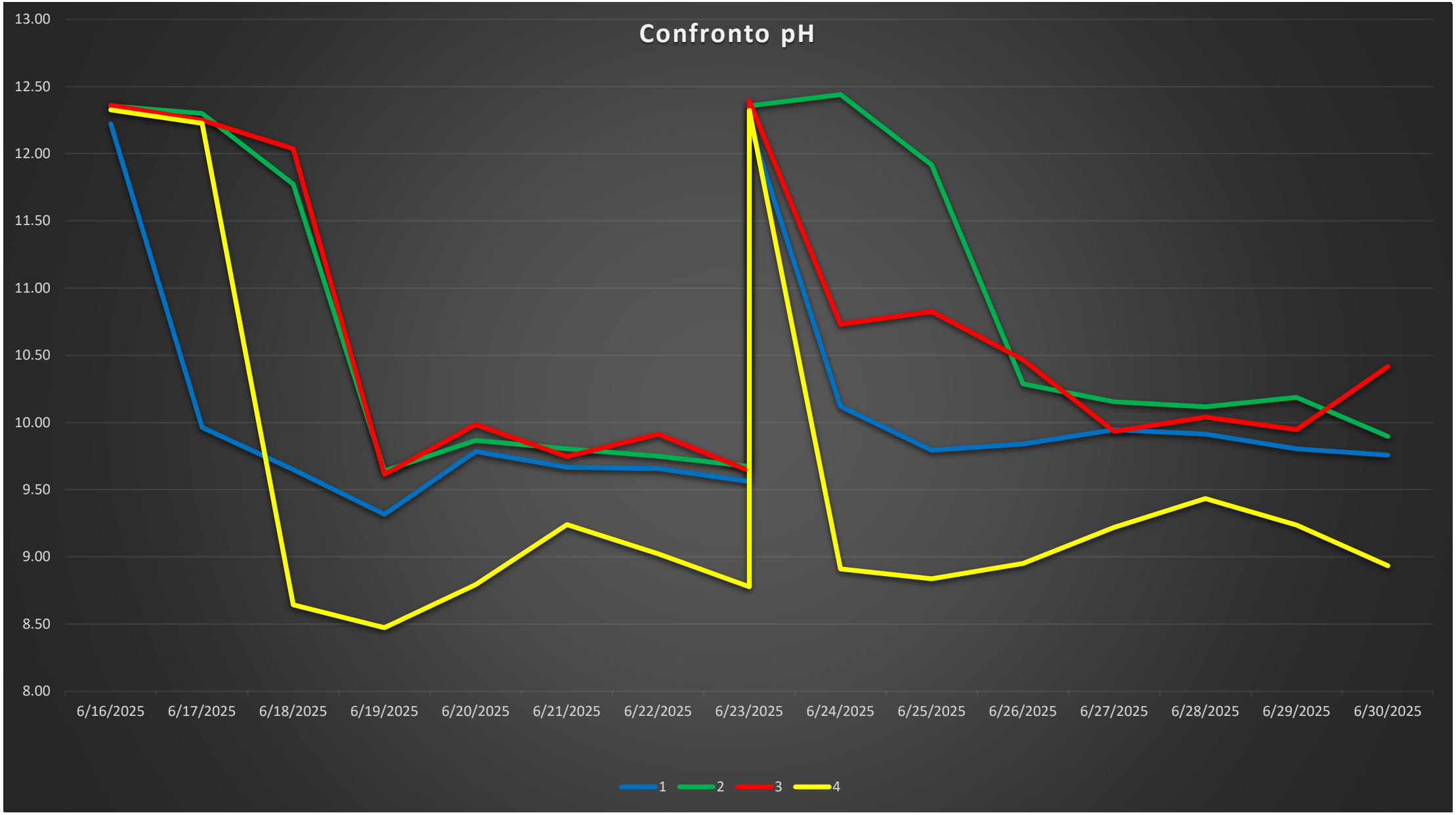
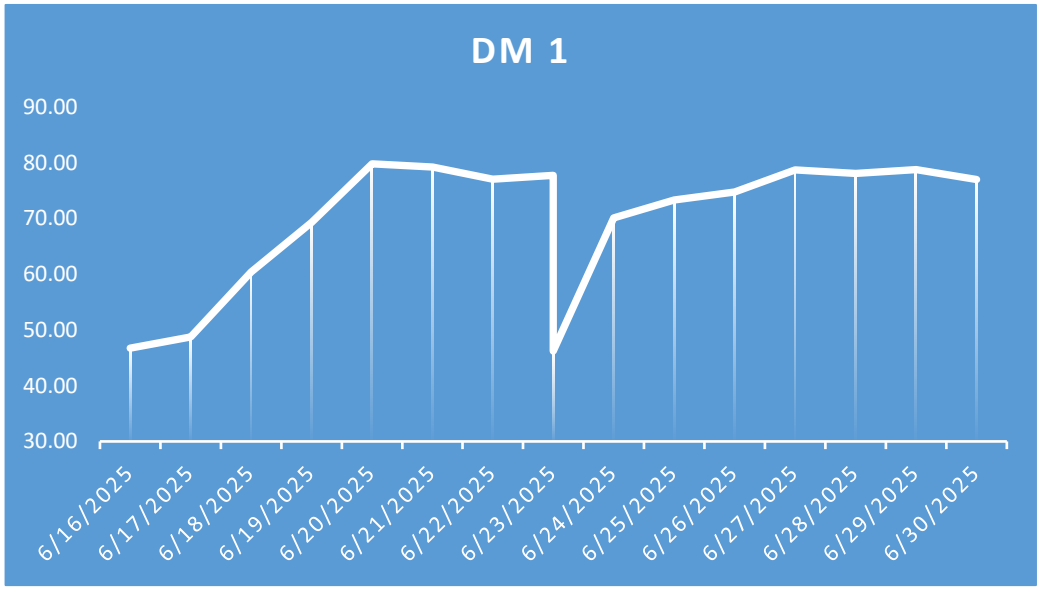


Barbieri tesi che sara' discussa il 30 ottobre 2025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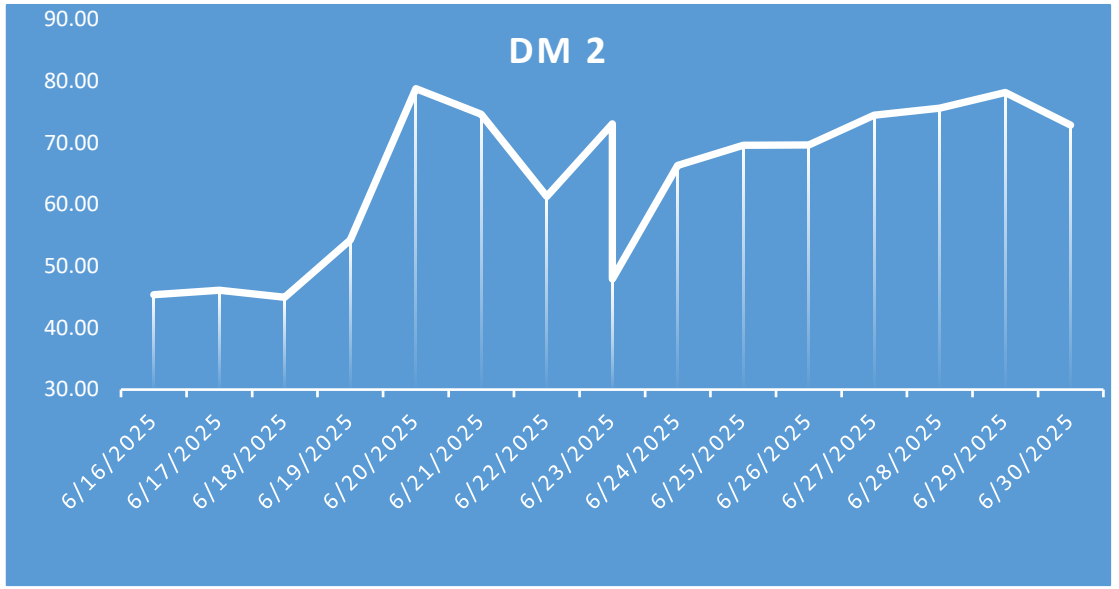
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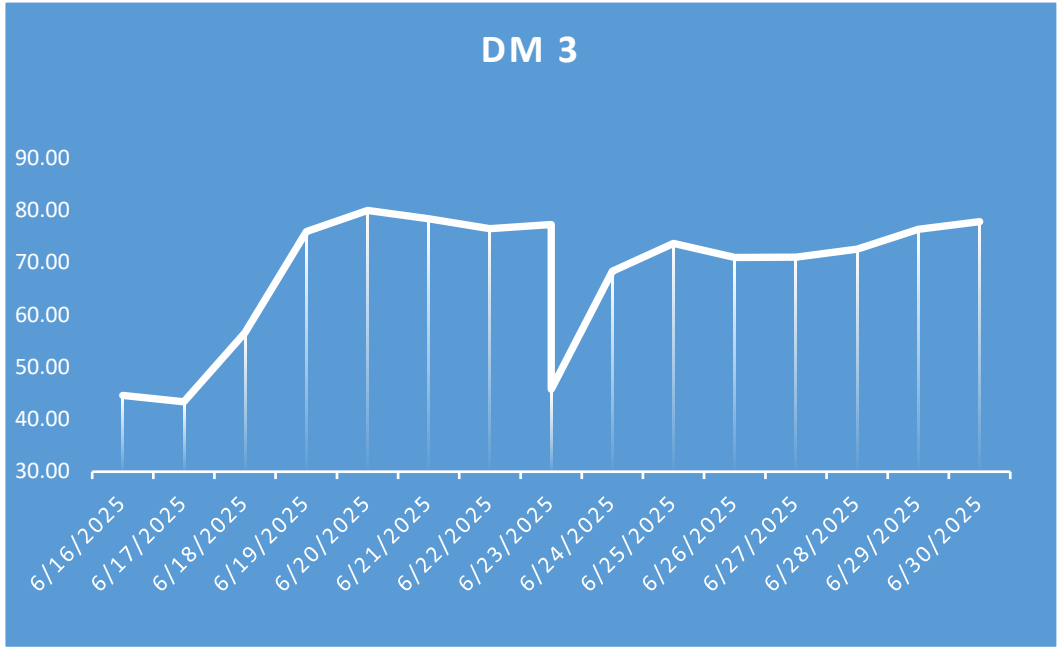
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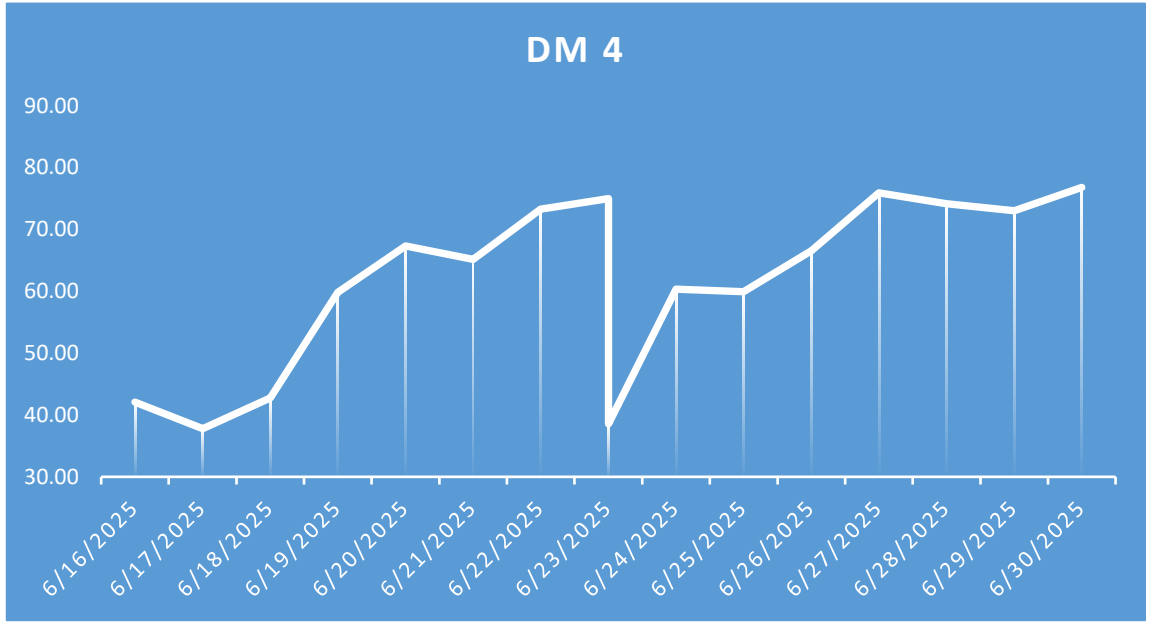
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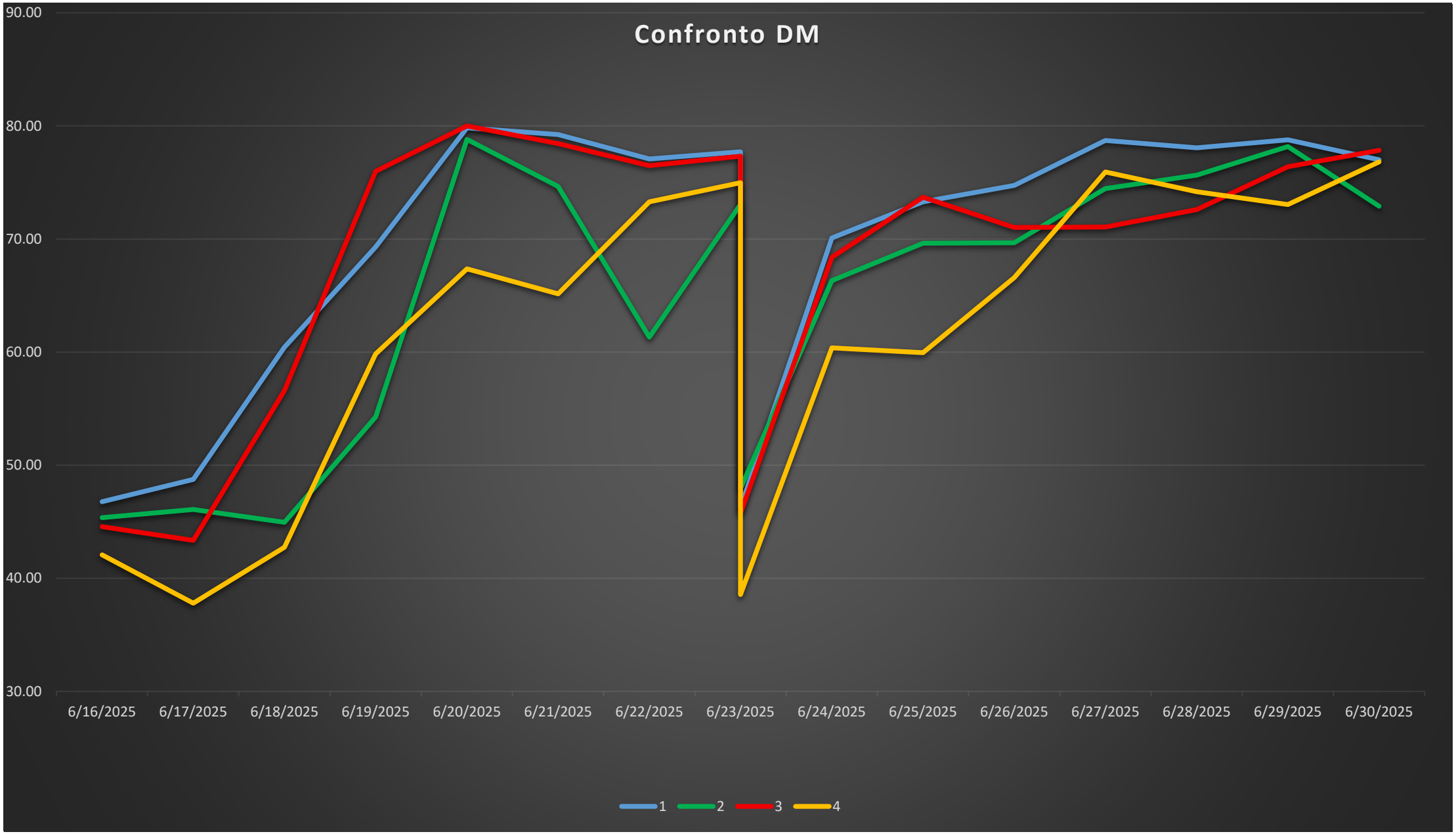

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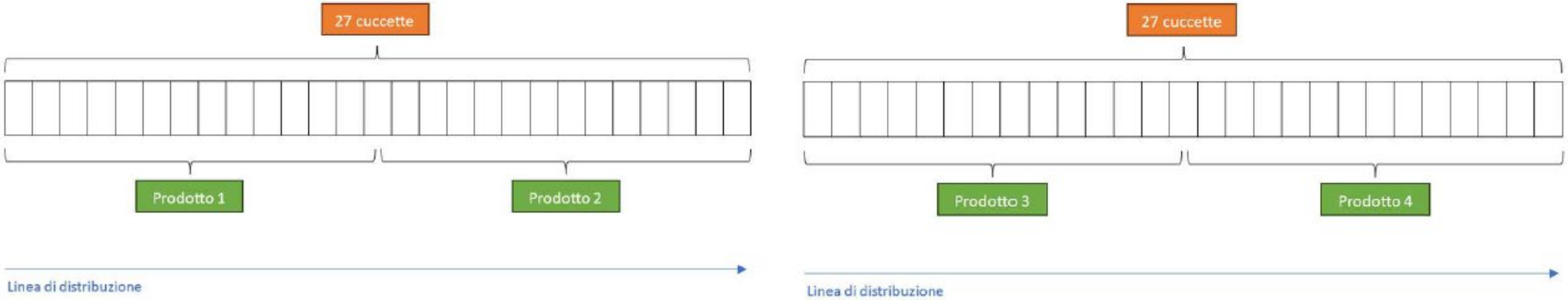
Preparazione Lettiera

6 q Paglia (25%) + 6 q (25%) Condizionatore + 12 q Acqua (50%)



Barbieri tesi che sara' discussa il 30 ottobre 2025

Domande che ci siamo posti

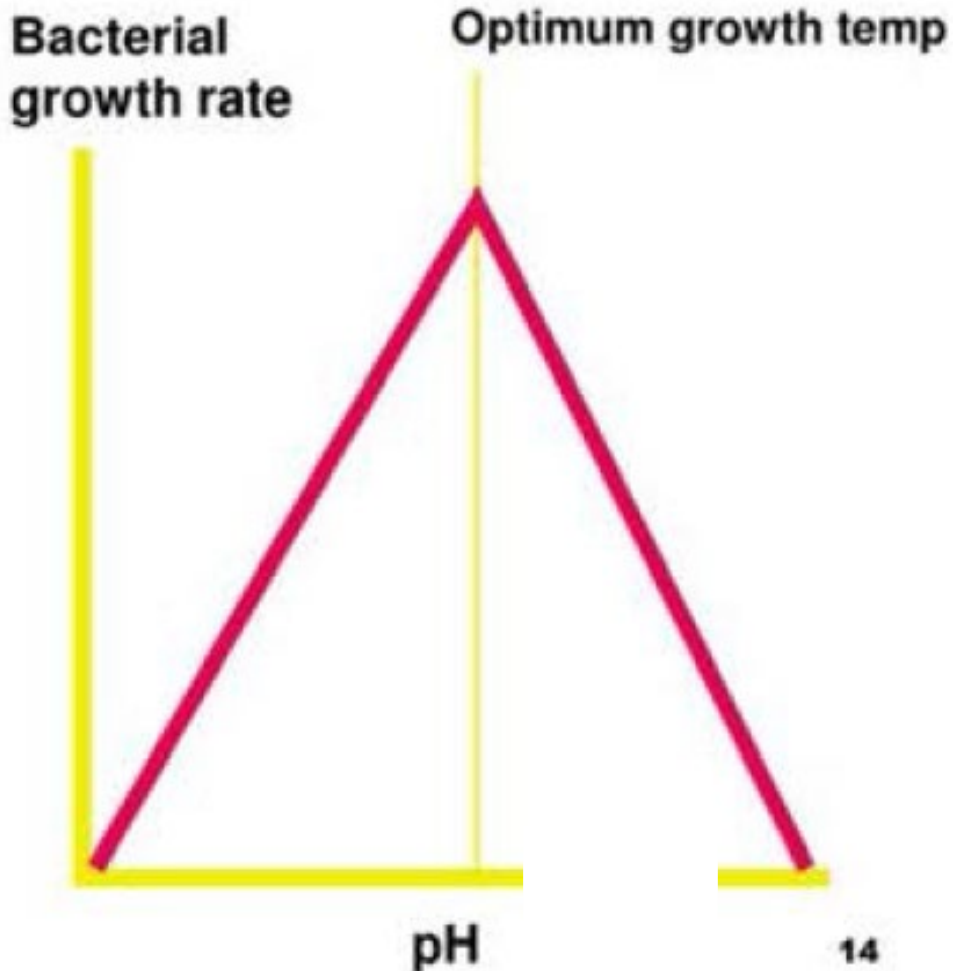
Quando?

Per quanto tempo% ?

Che% ?

Effetto del pH sulla crescita batterica

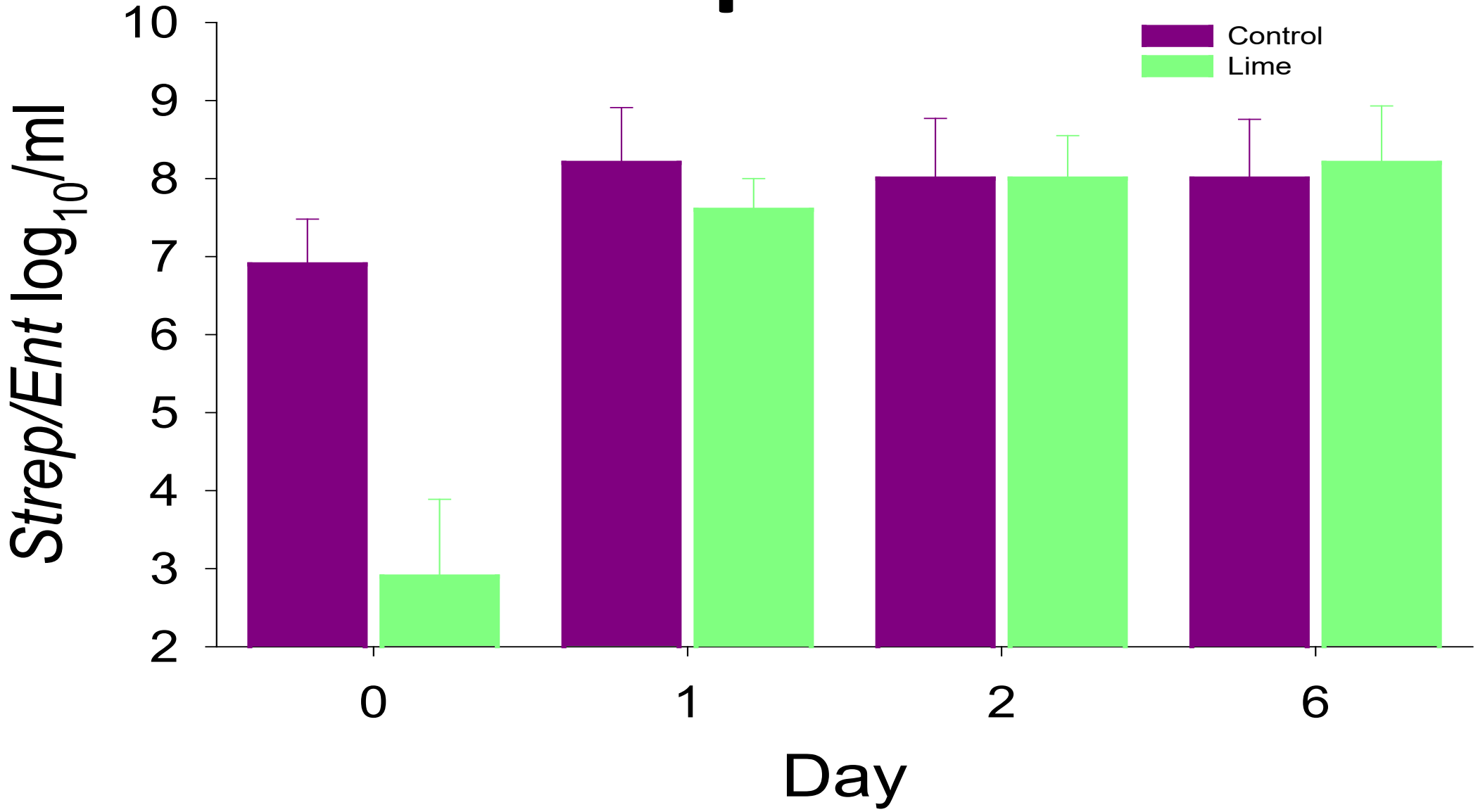
- Bacteria can grow over a range of pH values
- All bacteria have an optimum growth pH
- Most pathogenic bacteria are neutrophilic (opt. pH ~ 7)
- Products of bacterial metabolism are often acidic. Lower pH of growth medium
- Some bacteria grow at pH 2 (stomach acid)



Domanda che ci siamo posti?

Per quanto tempo ?

Separato



frontiers | Frontiers in Veterinary Science

TYPE Original Research
PUBLISHED 15 July 2024
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Effect of a lime-based bedding conditioner on physical-chemical characteristics and microbiological counts of recycled manure solids

Gustavo Freu[1,2†], Sara Fusar Poli[2†], Valentina Monistero[2,3], Filippo Biscarini[4], Nicola Rota[5], Delower Hossain[2,3,6], Claudia Gusmara[2,3], Laura Musa[2,3], Gloria Gioia[7], Lorenzo Leso[8], Marcos Veiga dos Santos[1], Paolo Moroni[2,3,7*], Maria Filippa Addis[2,3] and Valerio Bronzo[2,3]

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†These authors have contributed equally to this work and share first authorship

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PUBLISHED 15 July 2024

Materiali e Metodi

Tipo di materiale

- Separato
- Digestato
- Paglia

Tempi di produzione del materiale

- 1 giorno
- 3 giorni
- 6 giorni

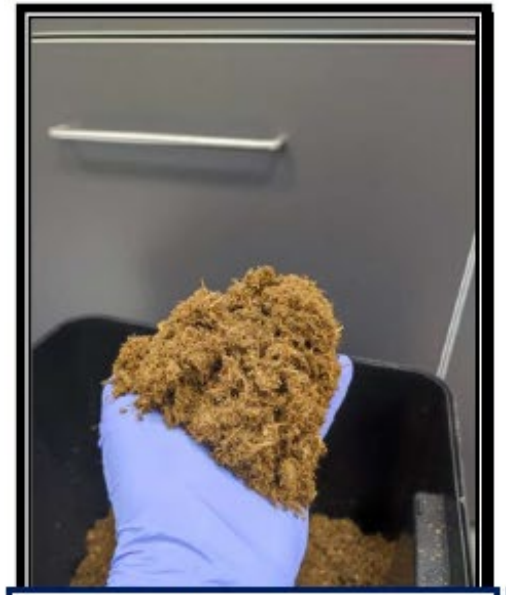
Tipo di Trattamento

- 0% di prodotto
- 10% di prodotto
- 15% di prodotto
- 20% di prodotto
- 25% di prodotto(solo paglia)

Tempi di lettura in laboratorio

- 0 giorno
- 1 giorni
- 3 giorni
- 7 giorni

Materiali e Metodi



Tipo lettiera

Prodotto

Prodotto applicato

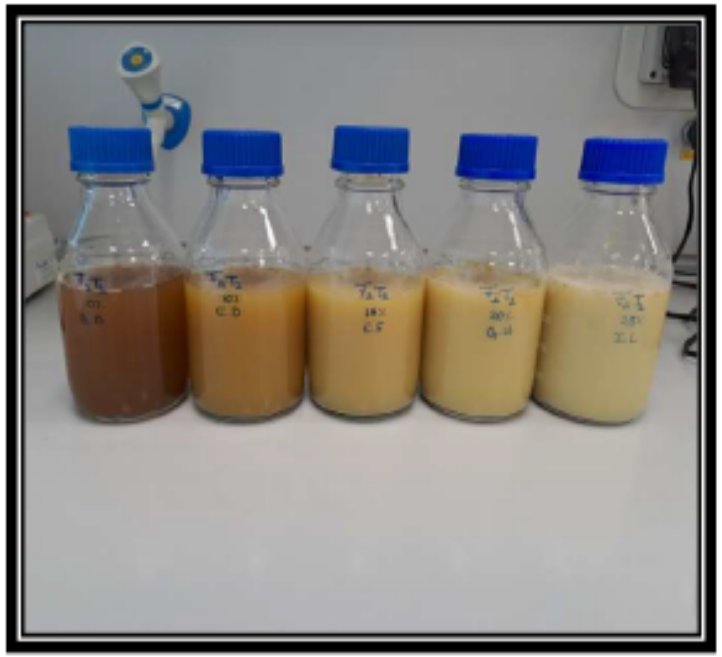
Prodotto conservato

Carbonato di calcio, magnesio e calce minerale semi idratata dolomitica

Materiali e Metodi

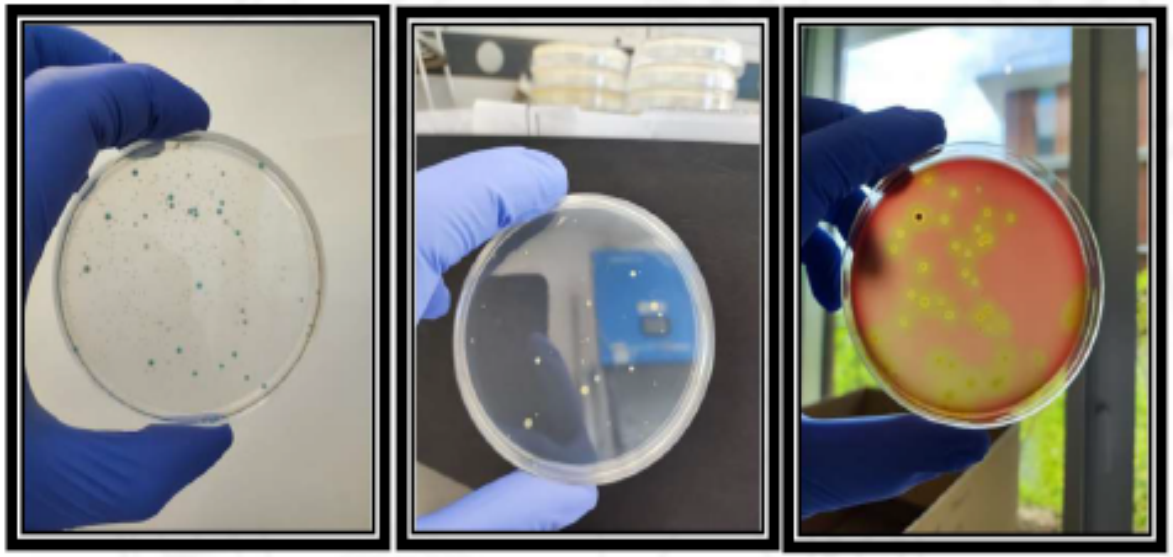
Microbiological analyses

- Gram-negative bacteria (Chromagar™ ECC)
- Total bacteria count (PCA)
- *Streptococcus* (Edward's modified)

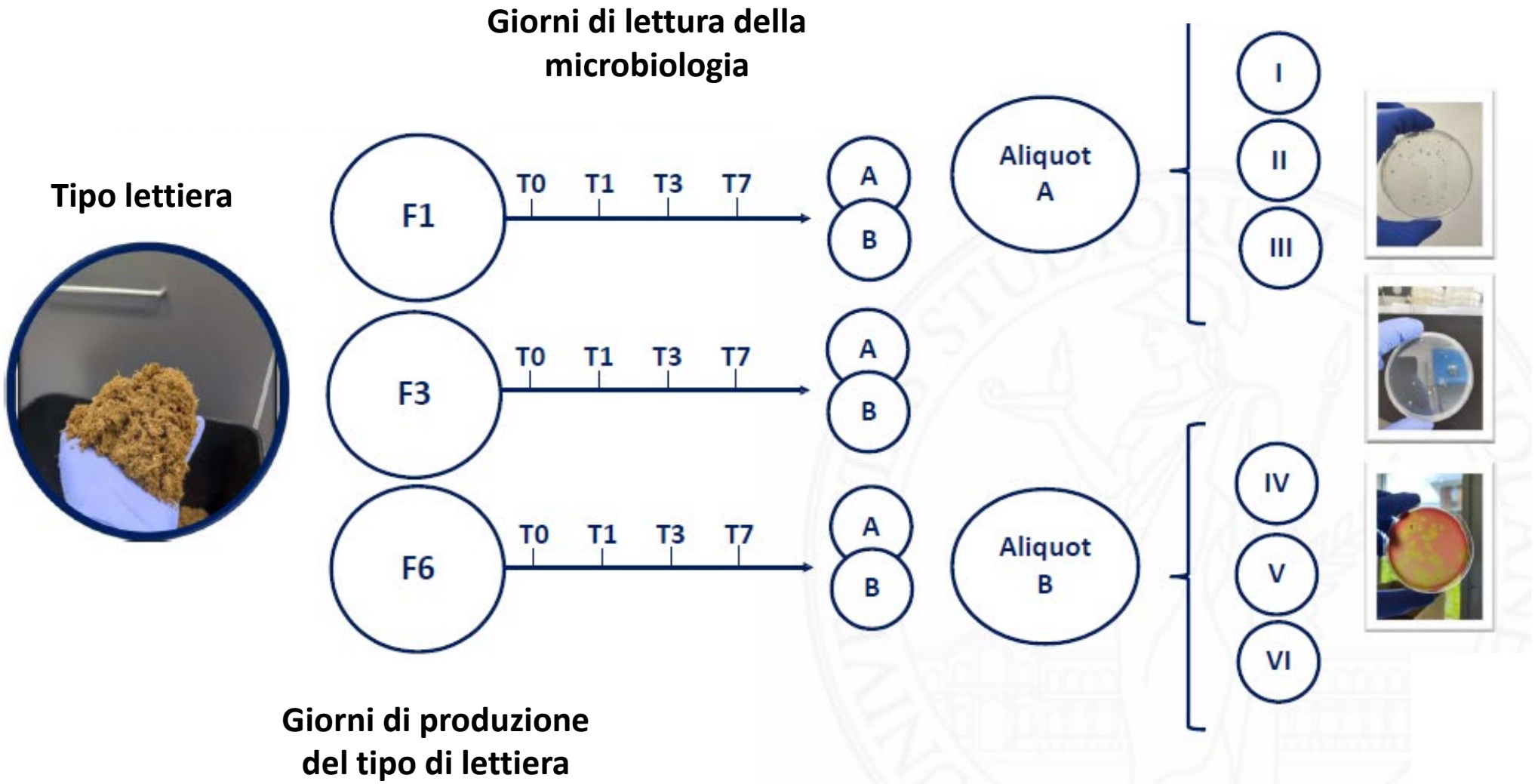


Serial dilutions

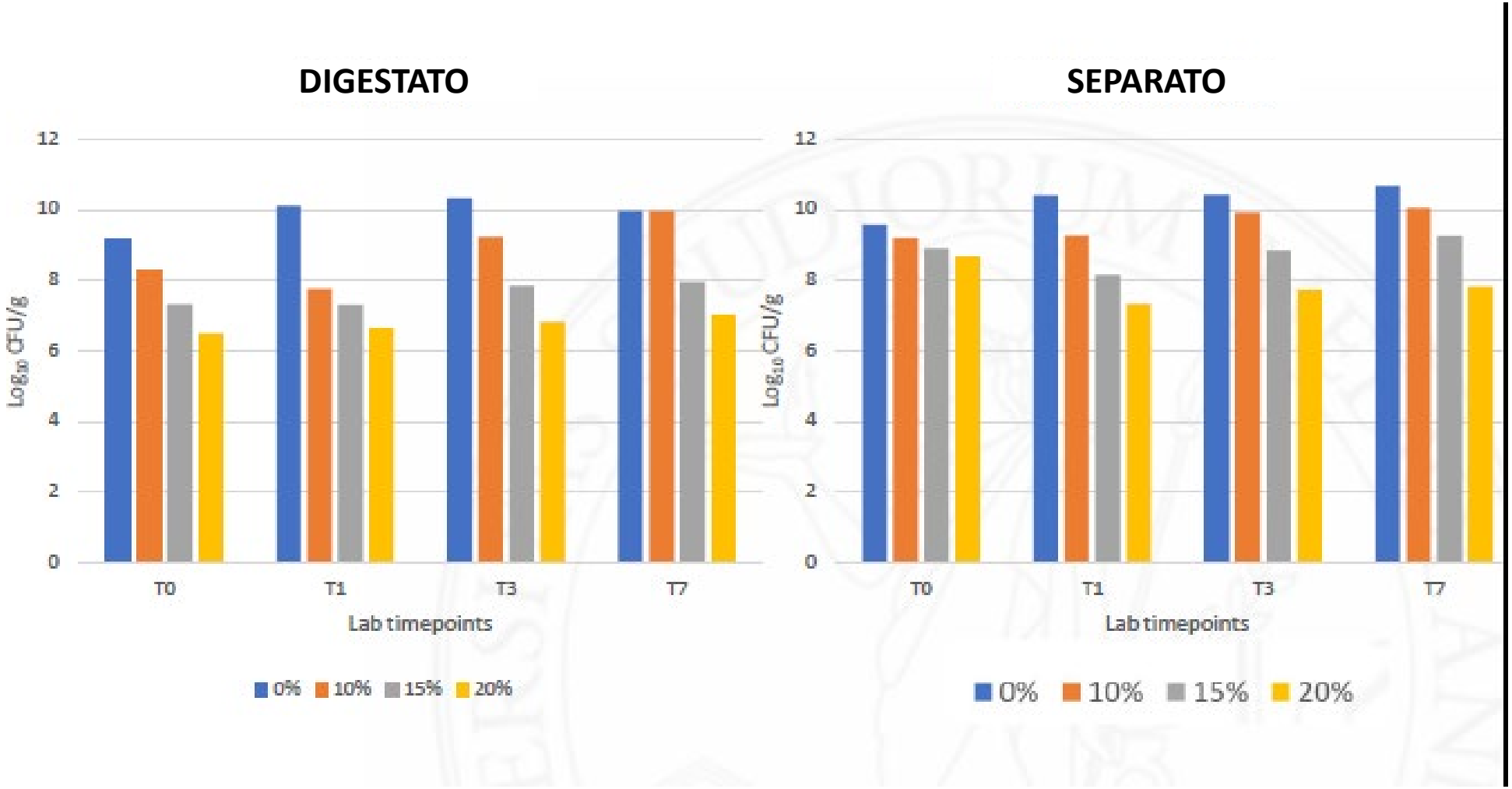
10^{-1} to 10^{-8}



Materiali e Metodi

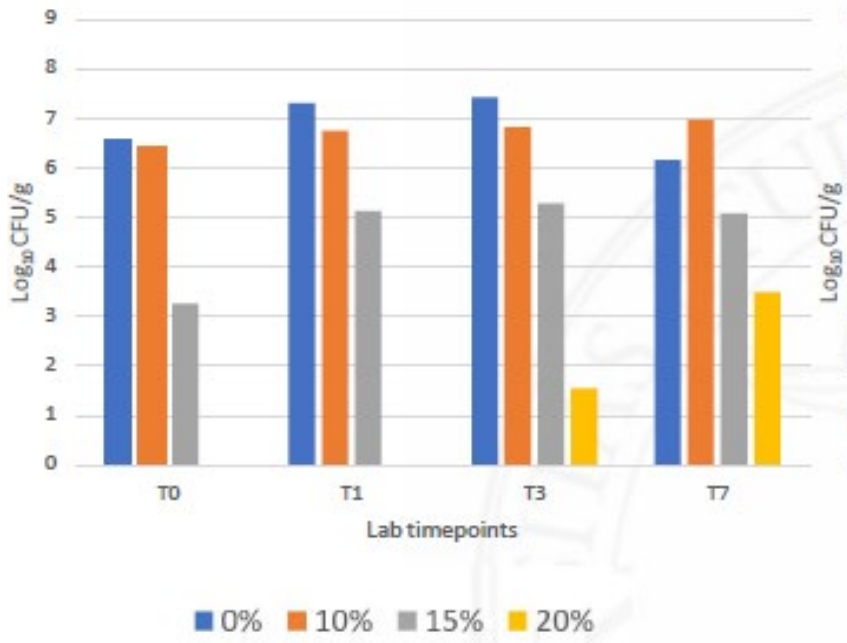


Carica batterica totale del separato e digestato

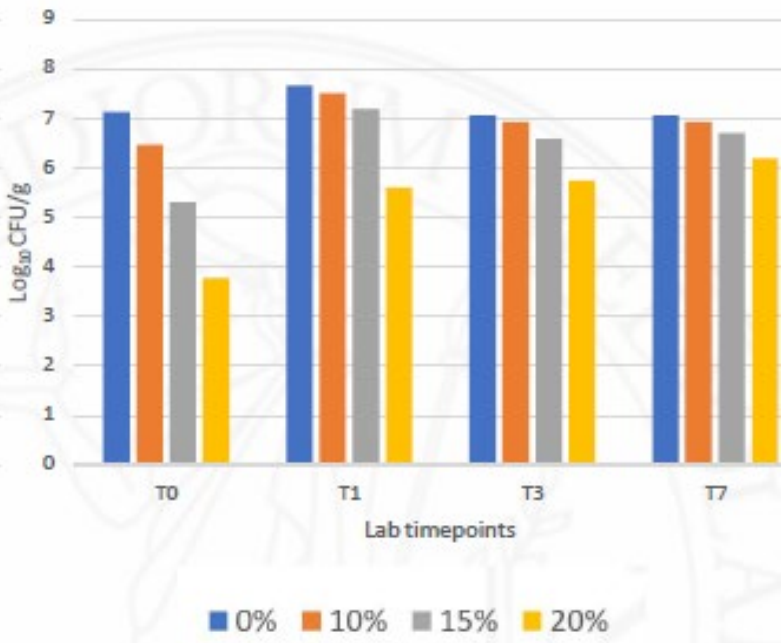


Carica batterica del separato e digestato

DIGESTATO



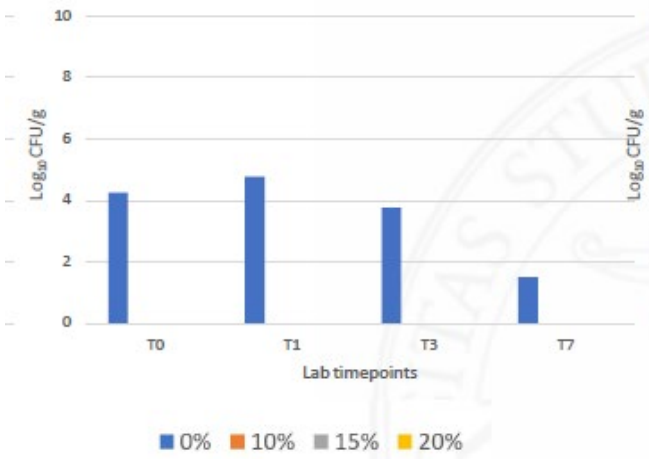
SEPARATO



STREPTOCOCCHI

Carica batterica del separato e digestato

DIGESTATO



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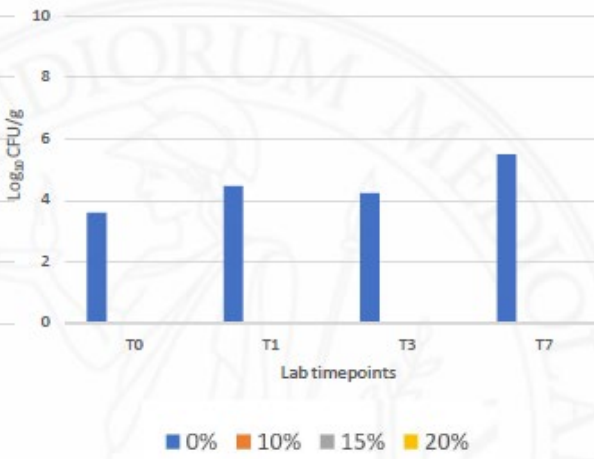
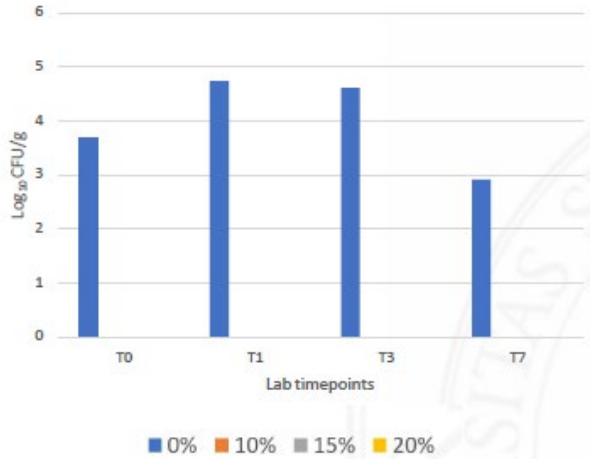


COLIFORMI

DIGESTATO



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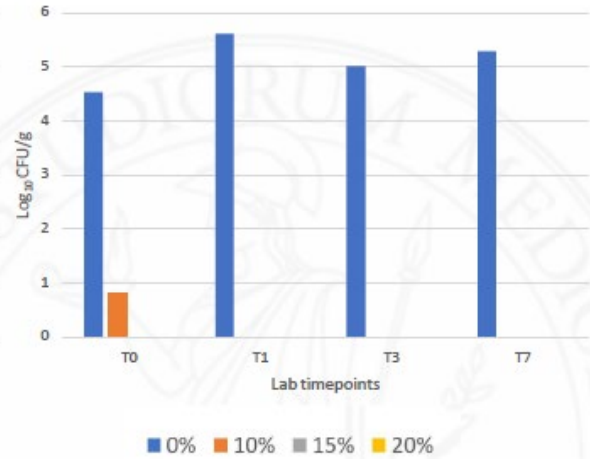

E.coli

Risultati

Table 1. DM and pH results (mean ± SD) of anaerobically digested manure solids and separated raw manure solids treated with different concentrations of lime-based conditioner according to the evaluated lab-times.

Variable	Time-points (h)[1]	DIGESTATO				SEPARATO			
		0%[4]	10%[5]	15%[6]	20%[7]	0%	10%	15%	20%
Sostanza secca	0	32.49 ± 0.02	40.68 ± 0.44	43.87 ± 0.20	47.40 ± 0.44	32.14 ± 0.28	39.15 ± 0.18	42.16 ± 0.36	45.71 ± 0.28
	24	32.72 ± 0.16	40.82 ± 0.43	43.85 ± 0.14	47.07 ± 0.13	32.67 ± 0.51	39.80 ± 0.18	42.69 ± 0.22	46.52 ± 0.69
	72	33.18 ± 0.19	41.18 ± 0.54	44.62 ± 0.43	47.58 ± 0.26	32.69 ± 0.51	39.97 ± 0.61	42.93 ± 0.26	47.26 ± 0.26
	168	33.18 ± 0.51	41.26 ± 1.08	43.68 ± 2.82	48.16 ± 0.87	32.55 ± 0.72	39.83 ± 0.41	44.66 ± 0.26	48.18 ± 0.51
pH	0	8.66 ± 0.00	10.95 ± 0.00	11.71 ± 0.00	12.02 ± 0.00	8.54 ± 0.03	11.35 ± 0.02	11.97 ± 0.02	12.22 ± 0.01
	24	8.71 ± 0.01	10.14 ± 0.01	10.74 ± 0.03	11.64 ± 0.02	7.97 ± 0.01	10.31 ± 0.01	11.09 ± 0.01	11.93 ± 0.01
	72	8.51 ± 0.01	10.10 ± 0.02	10.51 ± 0.01	11.46 ± 0.04	7.69 ± 0.01	9.29 ± 0.02	10.47 ± 0.02	11.72 ± 0.03
	168	8.42 ± 0.00	9.25 ± 0.00	10.38 ± 0.00	11.38 ± 0.00	7.81 ± 0.01	9.01 ± 0.00	10.19 ± 0.02	11.42 ± 0.01

[1] Sample processed immediately (0 h), and after 24 h, 72 h, and 168 h of storage at 28°C;

Table 4. Microbiological count results (mean ± SD log_{10} cfu/g) of anaerobically digested manure solids and separated raw manure solids treated with different concentrations of lime-based conditioner according to the evaluated lab-times.

Bacterial group	Time-points (h)[1]	Digestato				Separato			
		0%[4]	10%[5]	15%[6]	20%[7]	0%	10%	15%	20%
Carica Batterica Totale	0	9.17 (± 0.08)	8.25 (± 0.01)	7.31 (± 0.08)	6.50 (± 0.10)	9.58 (± 0.03)	9.20 (± 0.04)	8.90 (± 0.11)	8.68 (± 0.10)
	24	10.12 (± 0.08)	7.76 (± 0.09)	7.30 (± 0.16)	6.65 (± 0.10)	10.41 (± 0.04)	9.27 (± 0.05)	8.16 (± 0.06)	7.34 (± 0.09)
	72	10.34 (± 0.05)	9.24 (± 0.18)	7.84 (± 0.08)	6.82 (± 0.07)	10.43 (± 0.06)	9.92 (± 0.08)	8.85 (± 0.08)	7.72 (± 0.08)
	168	9.97 (± 0.03)	9.96 (± 0.10)	7.95 (± 0.11)	7.03 (± 0.02)	10.67 (± 0.06)	10.05 (± 0.08)	9.26 (± 0.05)	7.82 (± 0.13)
Total Gram-negative	0	5.70 (± 0.06)	0.88 (± 1.37)	0.39 (± 0.96)	0.00 (± 0.00)	5.16 (±0.10)	0.80 (± 1.24)	0.00 (± 0.00)	0.00 (± 0.00)
	24	6.04 (± 0.12)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	6.95 (± 0.07)	2.36 (± 1.16)	0.00 (± 0.00)	0.00 (± 0.00)
	72	7.17 (± 0.04)	1.69 (± 1.32)	0.00 (± 0.00)	0.00 (± 0.00)	5.65 (± 0.06)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	168	5.47 (± 0.03)	3.00 (± 0.21)	0.00 (± 0.00)	0.00 (± 0.00)	7.14 (± 0.12)	3.50 (± 0.17)	3.03 (± 0.13)	0.00 (± 0.00)
E.coli	0	3.69 (± 0.13)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	4.53 (± 0.15)	0.80 (±1.24)	0.00 (± 0.00)	0.00 (± 0.00)
	24	4.74 (± 0.11)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	5.61 (± 0.10)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	72	4.61 (± 0.06)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	5.01 (± 0.05)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	168	2.91 (± 0.25)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	5.29 (± 0.16)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
Coliformi	0	4.26 (± 0.07)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	3.61 (± 0.09)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	24	4.78 (± 0.06)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	4.47 (± 0.13)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	72	3.76 (± 0.13)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	4.24 (± 0.15)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	168	1.51 (± 1.66)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	5.50 (± 0.14)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
Other Gram-negative	0	5.68 (± 0.06)	0.88 (± 1.37)	0.39 (± 0.96)	0.00 (± 0.00)	5.02 (± 0.12)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	24	5.99 (± 0.14)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)	6.92 (± 0.07)	2.36 (± 1.16)	0.00 (± 0.00)	0.00 (± 0.00)
	72	7.16 (± 0.04)	1.69 (± 1.32)	0.00 (± 0.00)	0.00 (± 0.00)	5.52 (± 0.07)	0.00 (± 0.00)	0.00 (± 0.00)	0.00 (± 0.00)
	168	5.47 (± 0.03)	3.00 (± 0.21)	0.00 (± 0.00)	0.00 (± 0.00)	7.12 (± 0.13)	3.50 (± 0.17)	3.03 (± 0.13)	0.00 (± 0.00)
Streptococchi	0	6.56 (± 0.14)	6.42 (± 0.05)	3.27 (± 0.26)	0.00 (± 0.00)	7.13 (± 0.09)	6.47 (± 0.12)	5.31 (± 0.04)	3.79 (± 0.32)
	24	7.31 (± 0.14)	6.75 (± 0.02)	5.13 (± 0.13)	0.00 (± 0.00)	7.66 (± 0.07)	7.51 (± 0.12)	7.19 (± 0.17)	5.60 (± 0.06)
	72	7.42 (± 0.09)	6.82 (± 0.18)	5.29 (± 0.10)	1.55 (± 1.20)	7.07 (± 0.18)	6.93 (± 0.09)	6.59 (± 0.13)	5.75 (± 0.19)
	168	6.16 (± 0.12)	6.98 (± 0.07)	5.08 (± 0.08)	3.50 (± 0.12)	7.07 (± 0.17)	6.93 (± 0.15)	6.71 (± 0.05)	6.19 (± 0.11)

Composted Packs

Can be difficult to establish a ‘working’ pack. Requires daily maintenance.‘

Effect of Manure Treatment Methods in Cowsheds on Udder Health and Milk Quality

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[1] Israel Dairy Board – National Service for Udder Health & Milk Quality
[2] Vulcani Institute – Laboratory for Preservation of Fodder and By-products

Treatments: In one barn, the pack was treated by harrowing the surface to a depth of up to 5 cm; in the second barn – deep cultivation was applied (30-50 cm). Neither method involved the addition of bedding material throughout the observation period. Cows were designated to two similar groups (73-76 cows in each group).Both groups were kept in barns of a similar structure and area per cow (22 sq.m./cow). Both packs were treated daily throughout the months of the observation. The effect of the various treatment methods were monitored by culturing of the pack for pathogens ,dry matter content , total cell count, differential cell count and the incidence of udder infections,.

RESULTS: A decrease was found in the total count ($p<0.04$), *Coliform* counts ($p<0.004$) and *Streptococcus* ($p<0.0001$) in the "deep cultivation group" as opposed to the "harrowing group". Significant differences were found in favor of the sampling points found in the deep cultivation barn and in the total dry mater in both barns (59.8% versus 47%) throughout the year ($p<0.001$). . The cows in the "cultivation group" were found to be cleaner in comparison in the different areas inspected on the cow's body and on average in the general cleanliness index of both groups. It was found that on average, the percentage of udder-healthy cows in the "cultivation group" was higher in most of the months compared to the "harrowing group" (70.6% versus 65.4%).Borderline significant differences were found ($p>0.067$) in the incidence of clinical infections.

T.1 PREGI E DIFETTI DEL SISTEMA COMPOST BARN

Vantaggi	Svantaggi
Zona riposo ampia, senza suddivisioni e ostacoli, gli animali possono muoversi liberamente e sdraiarsi assumendo le posizioni più naturali, senza costrizioni	Reperibilità non facile dei **materiali da lettiera** ottimali a prezzi convenienti
Superficie di riposo morbida, asciutta e confortevole, favorisce il decubito e la pulizia, agevola la deambulazione, favorendo la sanità di arti e piedi e manifestazioni comportamentali dell'estro	Elevata **rischiosità nell'uso di materiali da lettiera** derivanti dal compostaggio di matrici da verde urbano o segature troppo umide
Elevato **livello di benessere** animale, che può favorire la longevità delle bovine, riduzione dei costi della rimonta	Maggiori **costi di esercizio** per lettime, manodopera e mezzi meccanici per la gestione della zona di riposo
Aumento tasso di **rilevamento dei calori**, con evidenti benefici sulle performance riproduttive della mandria	**Stalle più costose**, per le elevate superfici in zona di riposo, nonostante la maggior semplicità costruttiva e i ridotti volumi di stoccaggio letame
Si adatta a **bovine di diversa mole** o di differente categoria	**Funzionamento non ottimale**, nel clima padano, durante il periodo freddo e umido, a causa del livello scarso di evaporazione
Riduzione **fabbisogni di stoccaggio** per materiale palabile: è possibile stoccaggio del letame all'interno della zona di riposo fino a una quantità definita dall'altezza della lettiera	In presenza di cattivo funzionamento **rischio di aumento delle emissioni** ammoniacali e degli odori molesti, contrariamente a quanto avviene in condizioni normali

Conclusioni

Importanza del tipo di lettiera e la sua gestione
Attenzione al prodotto da utilizzare tenendo conto delle differenti percentuali
Management importante