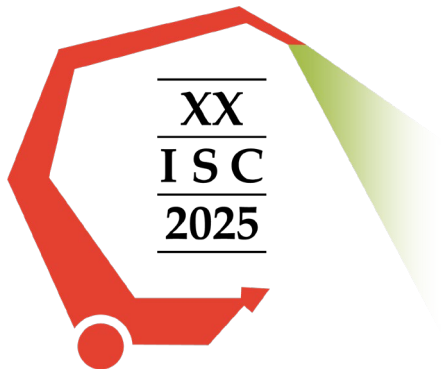




Optimizing Silage Production in Tropical Climates

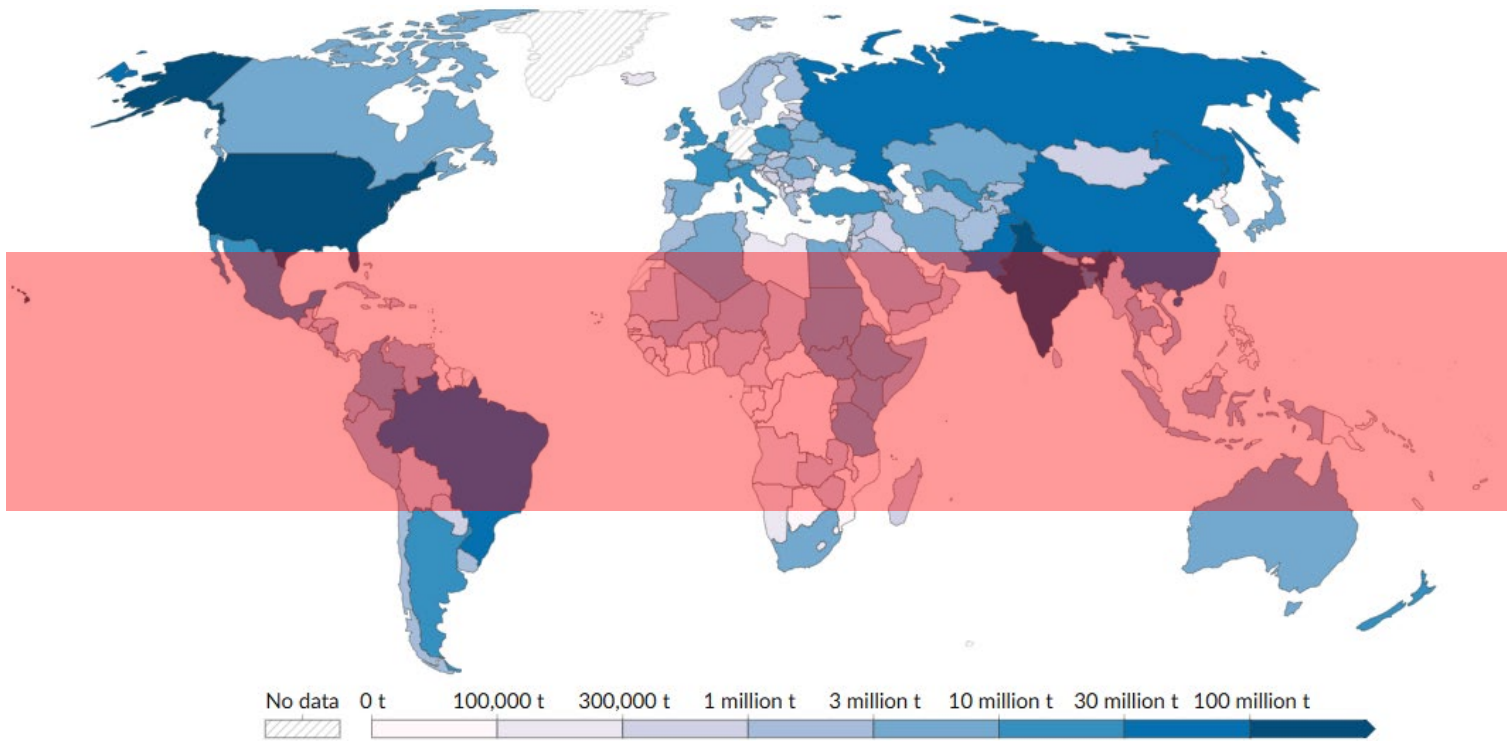
João Daniel

Janaina Bragatto

Matheus Carvalho

Florida, July 2025

Who are silage ‘potential’ clients in tropical zones?



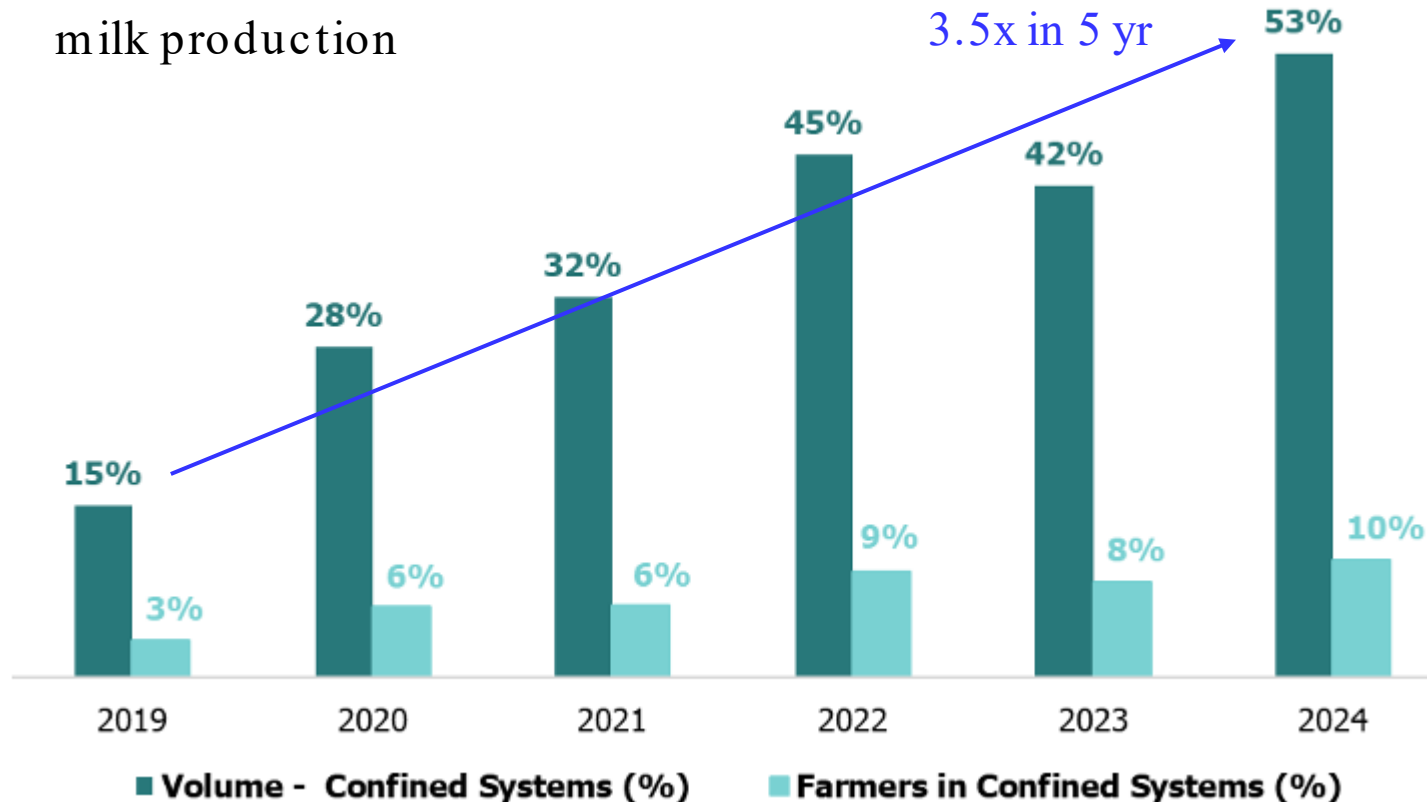
Source: FAO

Country	2023 Milk production (t)	Climate
India	239,307,000	Tropical
USA	102,702,760	
Pakistan	64,581,550	Parc. Tropical
China	46,790,810	Parc. Tropical
Brazil	36,741,640	Tropical

Who are silage clients in Brazil?



35 billion liters
milk production



Proportion of producers and milk originating from housed systems in Brazil
Source: MilkPoint Ventures

93 million tons of silage for dairy

Who are silage clients in Brazil?



7.4 million of heads finished in feedlots
+
~2 million of heads backgrounding in feedlots

12+ million tons of silage for beef

>105 million tons of forage silage in Brazil
+Grain silages

What silage?

- Corn silage is the main conserved forage
 - 83% of dairy farms (Bernardes and do Rêgo, 2014)
 - 56% of beef feedlots (Monsalve and Millen, 2025)
- Tropical grass silage is mainly important in beef operations
 - 24% of beef feedlots (Monsalve and Millen, 2025)
- Grain silages & snaplage are very present in beef (>50%) and dairy farms (enhanced feed efficiency & storage)



In the next few minutes ...



Recent research on:

- Whole plant corn silage
- Tropical grass silage
- Grain silage



Corn genotype trial (since 1988)



<https://guia.daforraagem.com.br/>



ESALQ



+ Coops, universities, farms & companies

Improving corn silage value by genetics



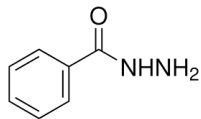
Híbrido	Valor nutricional (ton leite/ton MS)	Produtividade leite (ton leite/ha)
2300RR2	1.73	39.5
DKB 230PRO3	1.73	38.9
P 3456	1.61	38.9
P 2501	1.74	38.8
LG 3055PRO3	1.64	38.6
FS 481PW	1.72	38.5



Source: Igor Quirrenbach, Dakar Pesquisa Agrícola

Average difference between
superior and worst hybrids
>8 t milk/ha

Improving corn silage NDF digestibility without decreasing total lignin



Benzohydrazide
Inhibitor of the
phenylpropanoid pathway



26 & 43 d emergence

Corn silage composition

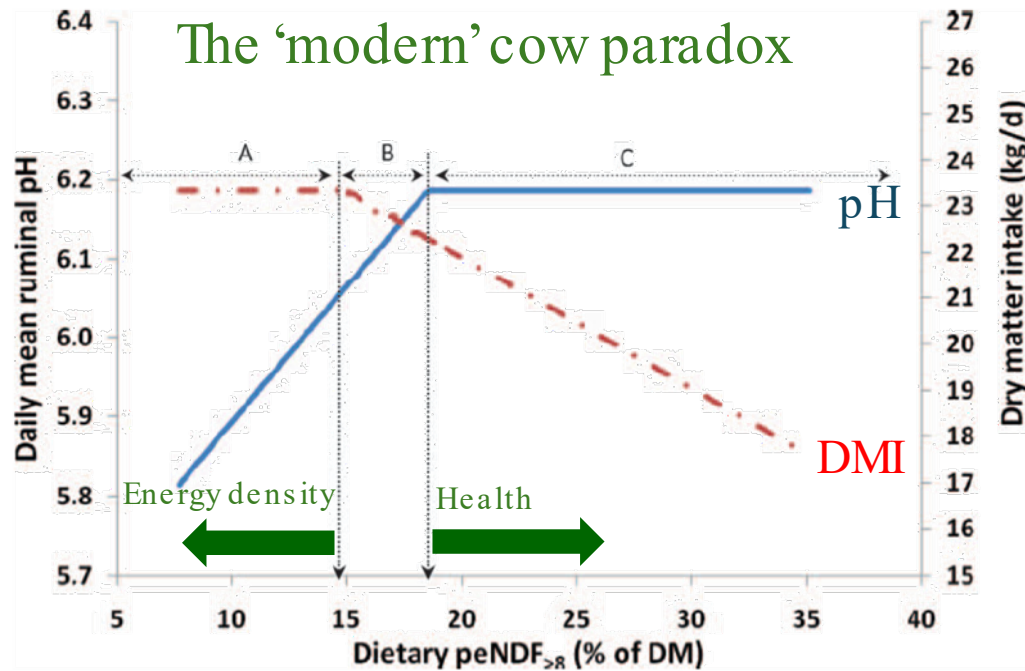
Item	CON	BZD
DM, % as fed	32.0	31.9
Starch, % DM	32.5	34.4
aNDF, % DM	40.5	41.0
Lignin(sa), % aNDF	4.96	4.26
Lignin(ab), % aNDF	20.2	20.0

Performance of dairy heifers (diet: 85% corn silage)

Item	CON	BZD	SEM	P-value
DM intake, kg/d	11.0	10.2	0.23	0.04
ME intake, Mcal/d	26.7	26.6	0.65	0.93
ADG, kg/d	1.32	1.38	0.042	0.34
Feed efficiency	0.128	0.142 ^{+10.9%}	0.003	0.01
TTDM digestibility, %	58.4	61.9	0.59	<0.01
TTNDF digestibility, %	34.0	37.5 ^{+10.3%}	1.43	<0.001
Plasma urea, mg/dL	25.1	22.7	1.29	<0.01

Source: Zoz et al. (2025)

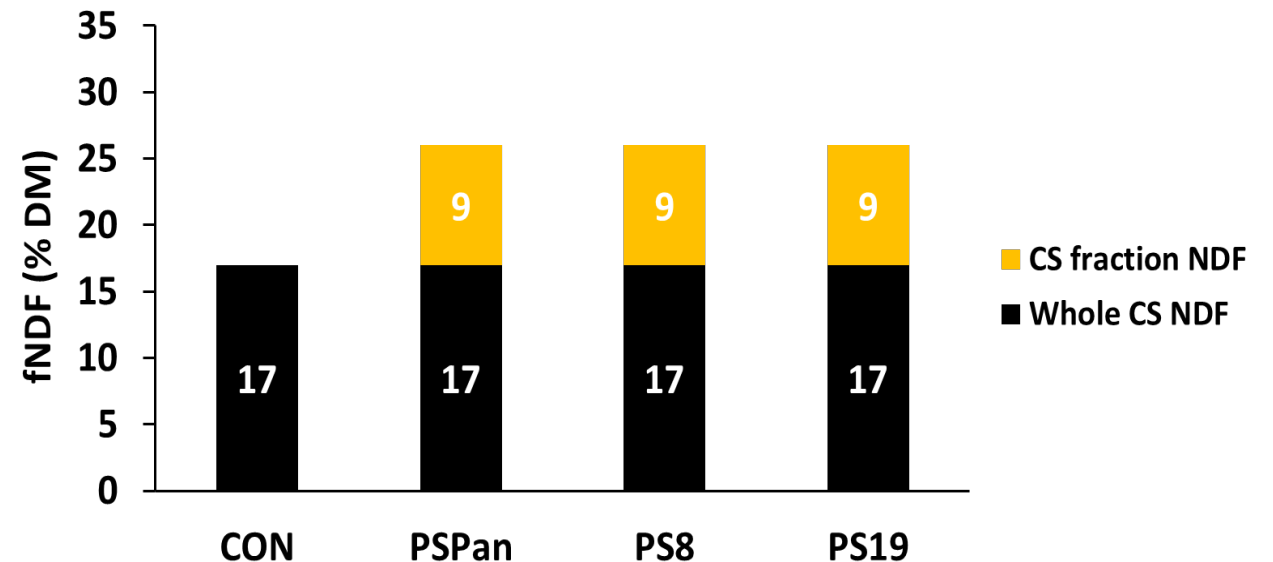
Improving cow health and performance by properly processing



Source: Zebeli et al. (2012)



>19 mm 8-19 mm <8 mm



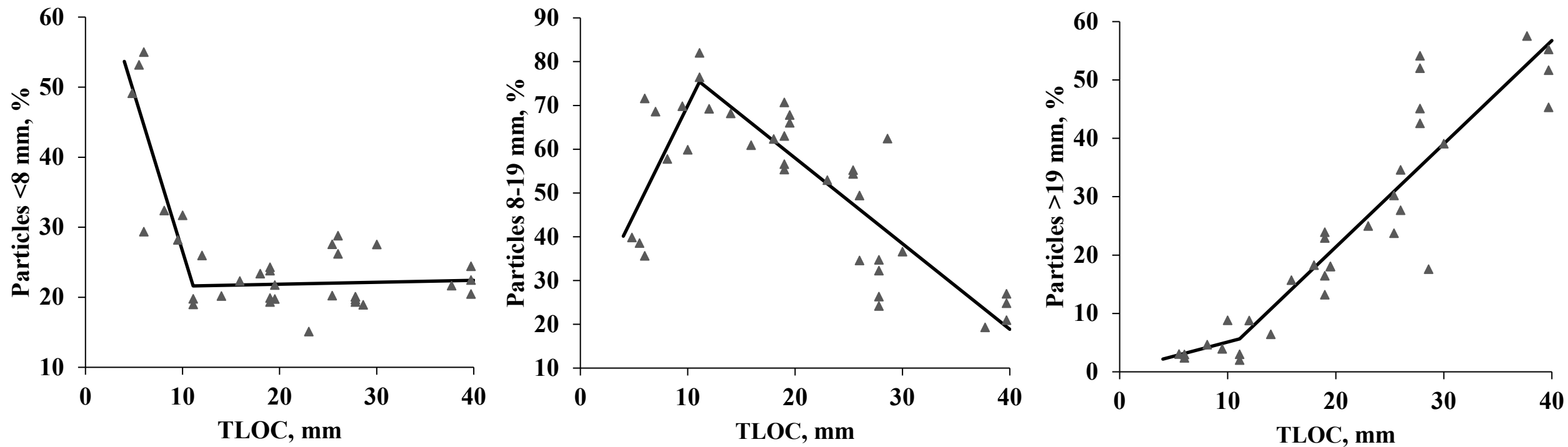
PS8 particles improve cow health and performance



Item	CON	PSPan	PS8	PS19
DML, kg/d	20.8 ^b	21.6 ^{ab}	22.4 ^a	21.2 ^b
3.5%FCM, kg/d	24.7 ^b	26.0 ^{ab}	27.2 ^a	25.2 ^b
Fat, %	3.18 ^b	3.43 ^{ab}	3.62 ^a	3.46 ^{ab}
Sorting >19 mm, %	90 ^a	91 ^a	89 ^{ab}	78 ^b
Sorting diet NDF, %	99 ^a	99 ^a	98 ^a	95 ^b
Rumination, min/d	383 ^b	424 ^{ab}	462 ^a	425 ^{ab}
Chewing, min/d	603 ^b	659 ^{ab}	718 ^a	657 ^a
Rumen pH < 5.8, h/d	11.1 ^a	3.36 ^b	2.50 ^b	3.02 ^b
Blood LPS, EU/mL	0.18 ^a	0.17 ^a	0.03 ^b	0.03 ^b

Source: Piran Filho et al. (2023)

Relationship between TLOC and particle size distribution of corn silage



Source: Piran Filho et al. (2023)

Improving corn silage feeding value by properly sealing



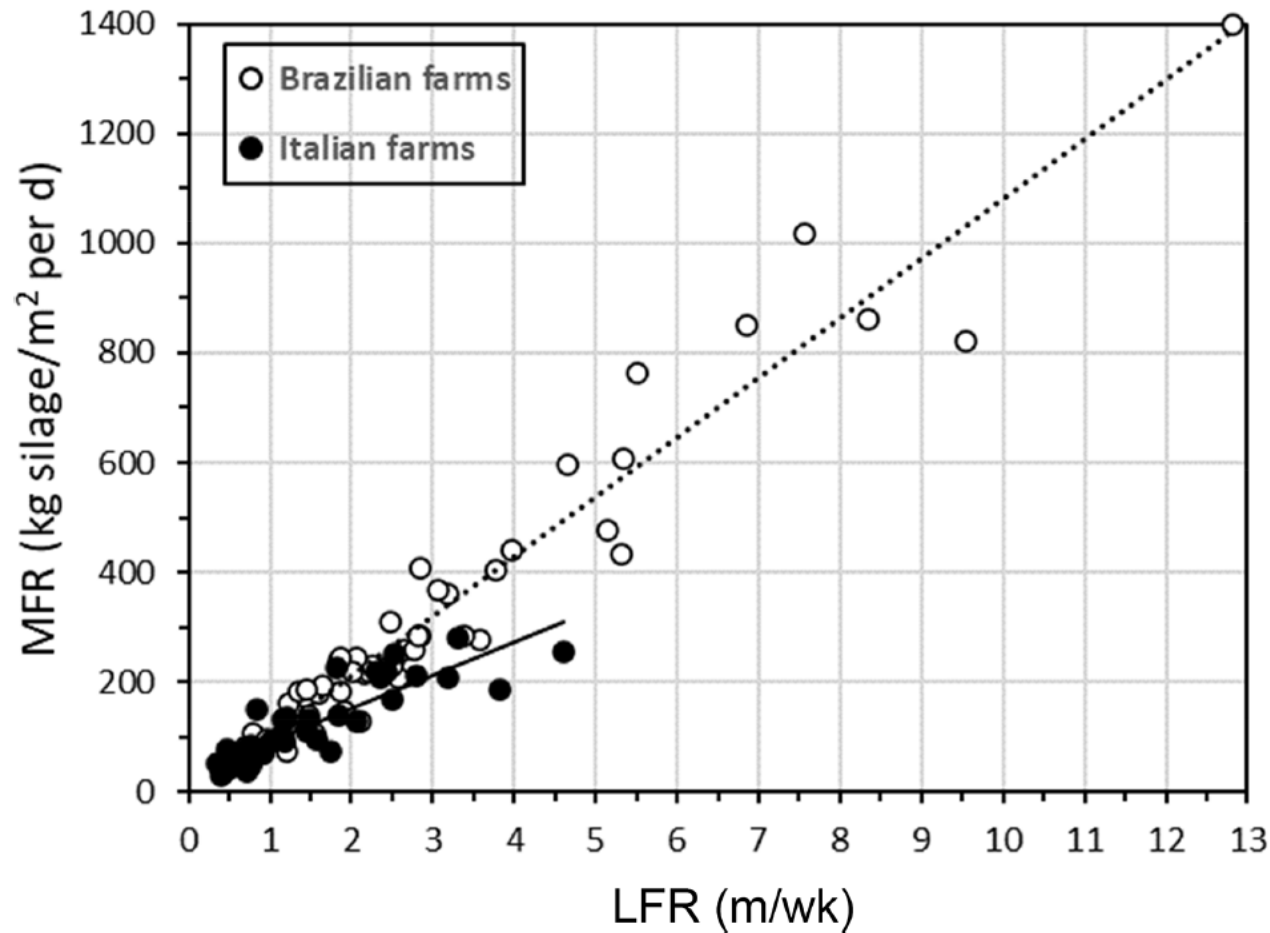
Performance of dairy heifers (diet: 80% corn silage)

Item	PE	OB	SEM	P-value
Inedible silage, % DM	4.00	0.82	0.35	<0.01
TMR aerobic stability, h	19.3	47.9	11.1	<0.01
Meals, /d	10.8	12.3	0.35	0.01
DM intake, kg/d	9.4	10.2	0.55	0.01
ADG, kg/d	1.08	1.21	0.085	0.01
G:F	0.119	0.119	0.005	0.98

Source: Parra et al. (2021)



Improving corn silage quality by properly unloading



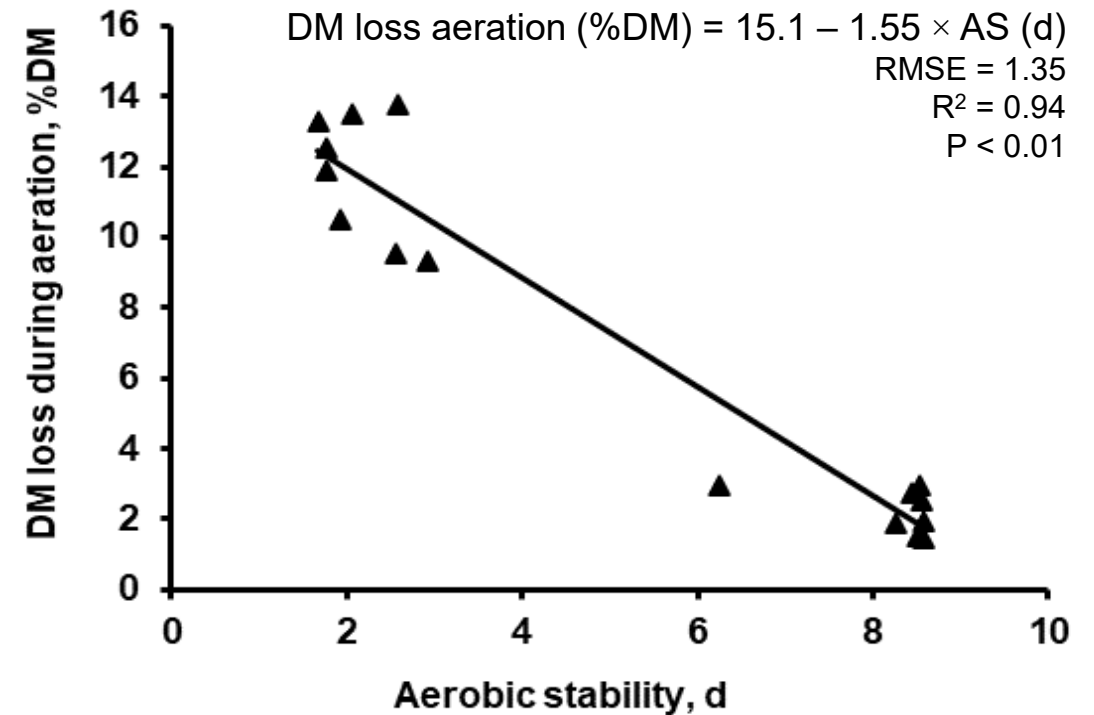
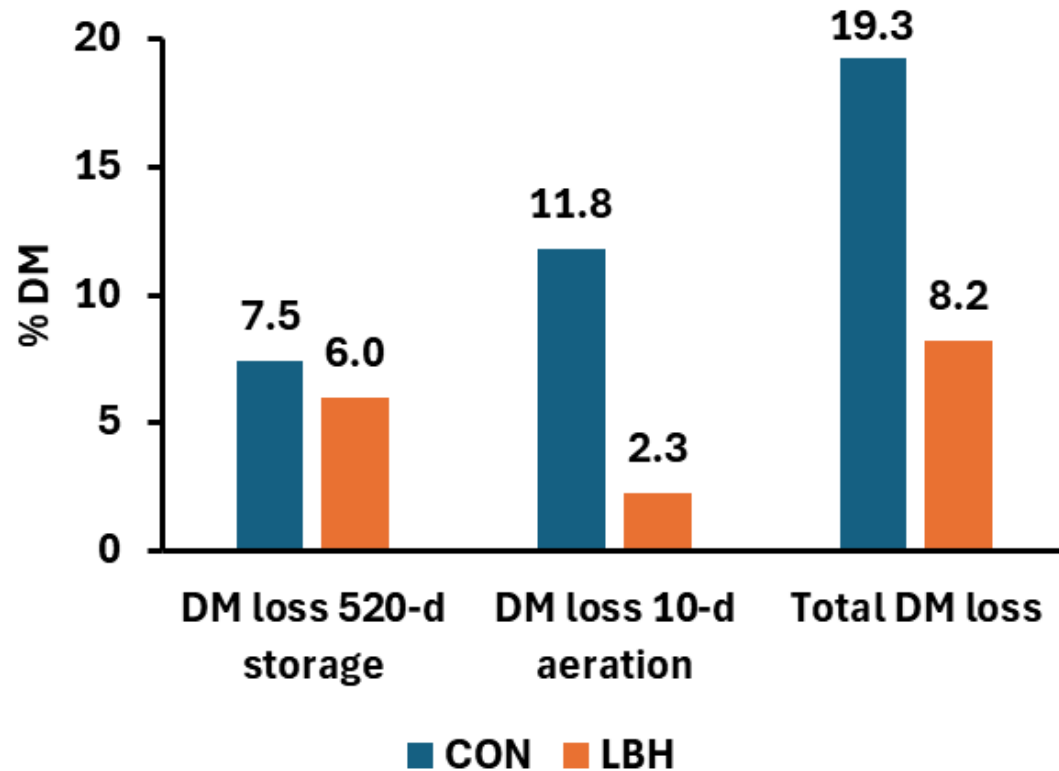
Source: Bernardes et al. (2021)

Daily removal rate:

>250 kg of silage/m²
markedly reduces the
risk of spoilage.

<150 kg of silage/m²
requires integrated
management strategies
to mitigate aerobic
deterioration.

How much is aerobic stability worth?



Source: Paz et al. (2025)

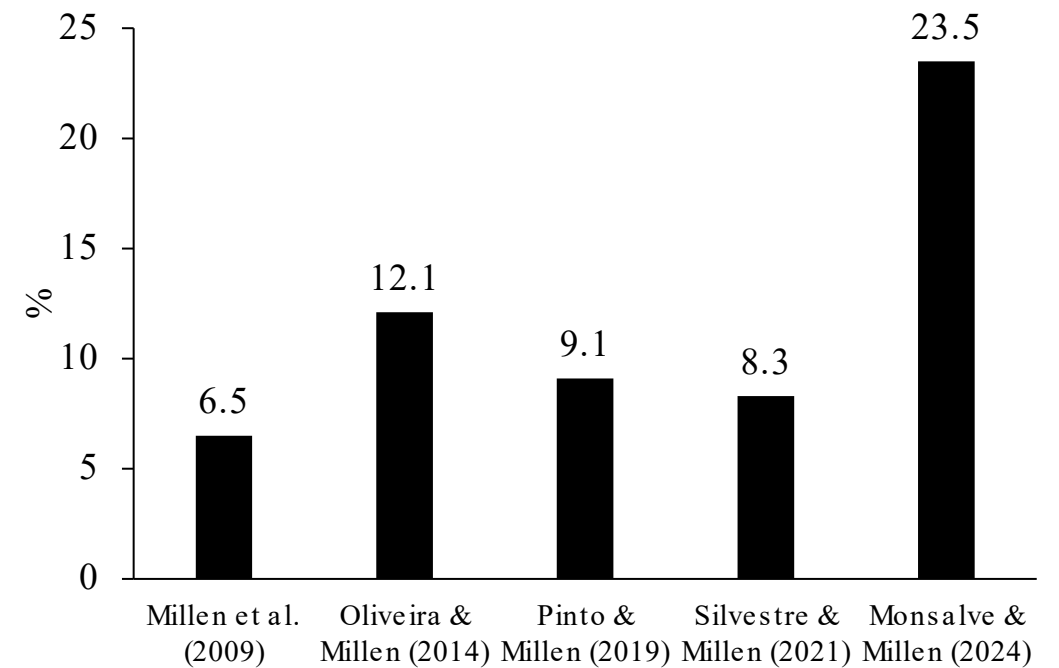
Each +1 day of aerobic stability represented a reduction of 1.55%-unit in DM loss during feedout.

Tropical grass silage

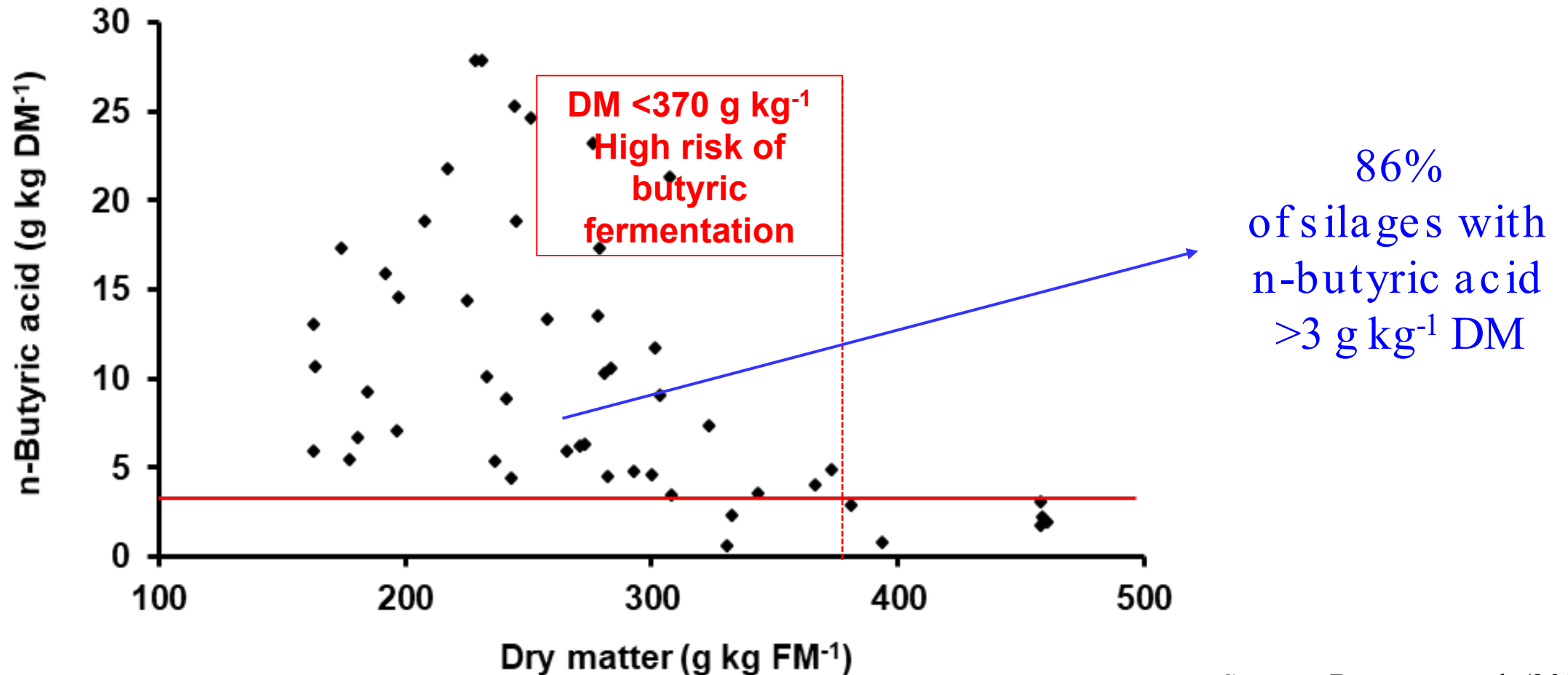


<https://portaldbo.com.br/>

Tropical grass silage in Brazilian feedlots

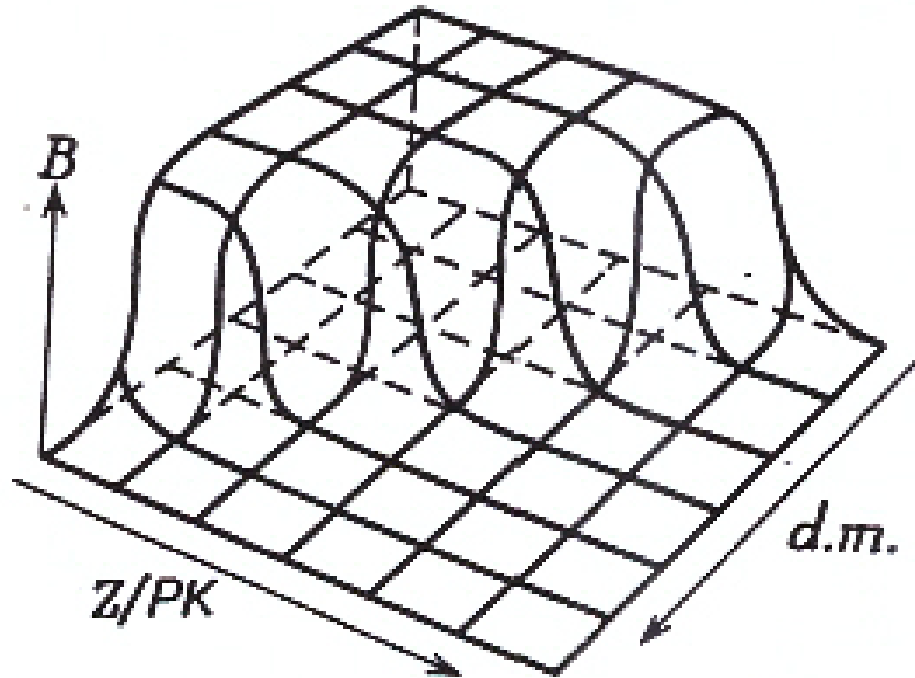


Tropical grass silage survey in BR beef farms



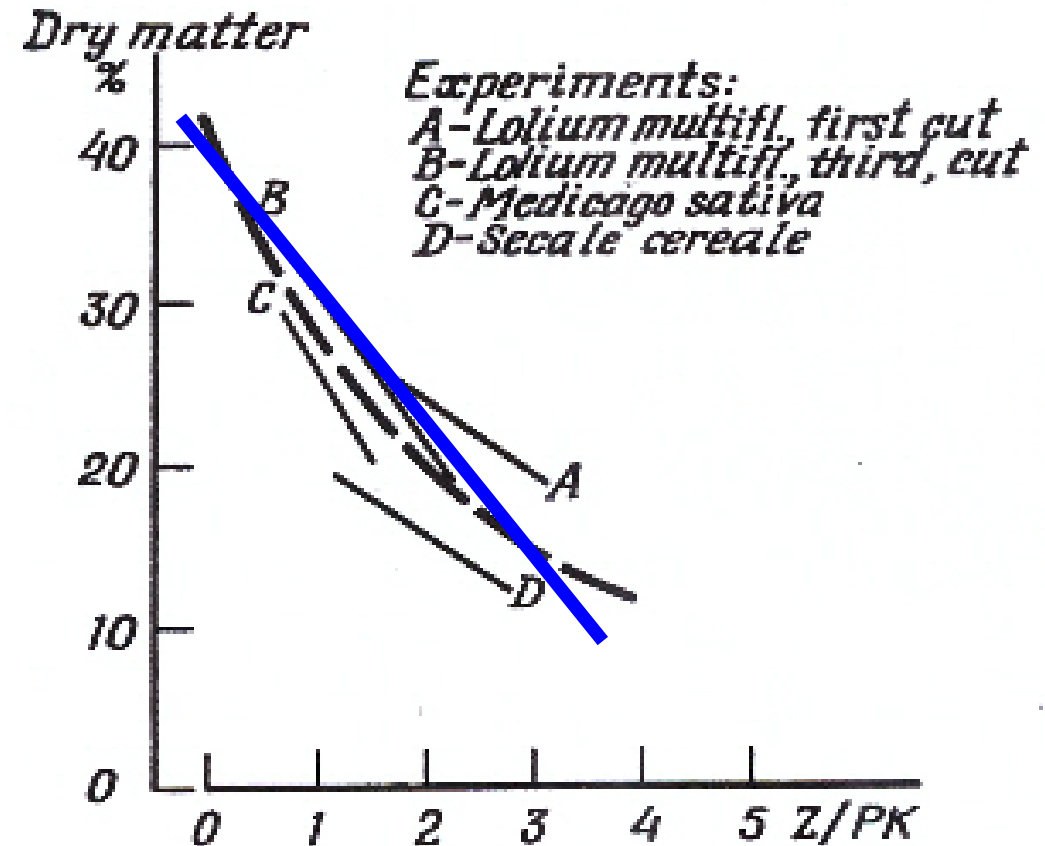
Source: Bragatto et al. (2024)

The fermentability coefficient (FC) concept



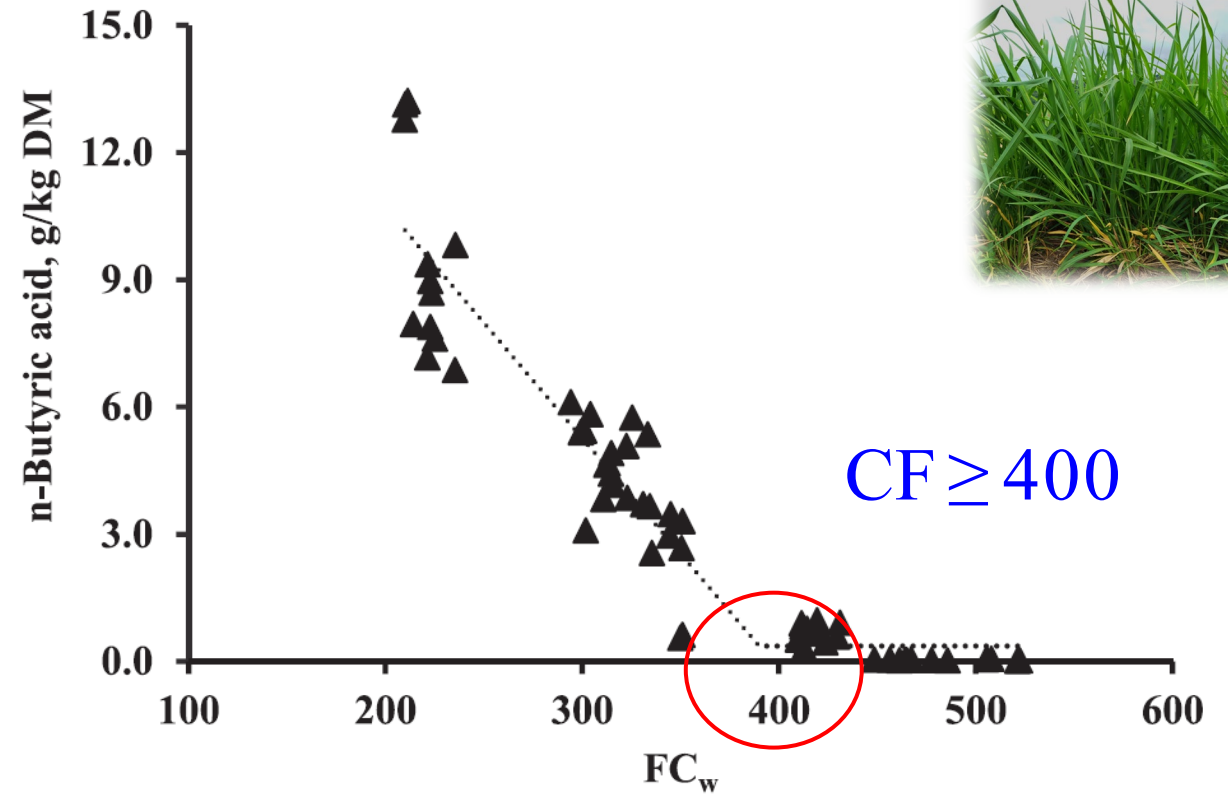
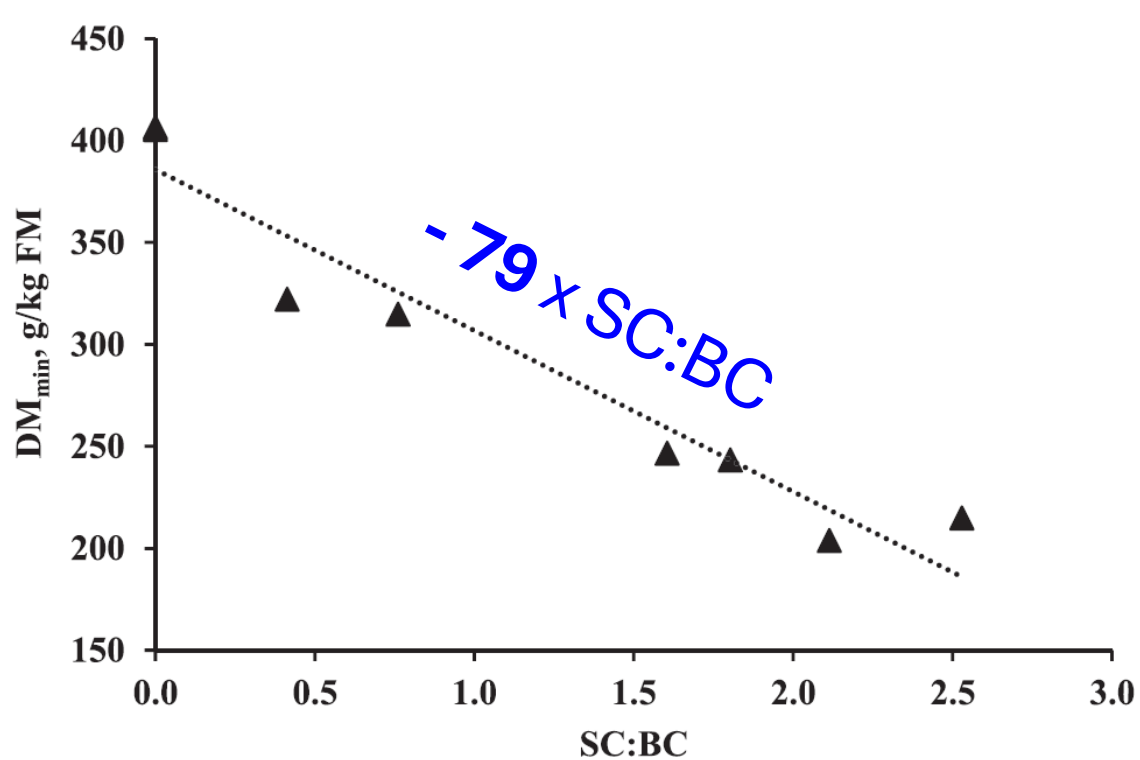
$$DM_{\min} = 450 - 80 \times SC:BC$$

$$SC:BC \sim 0.5 \rightarrow DM_{\min} \geq 360 \text{ g kg}^{-1}$$



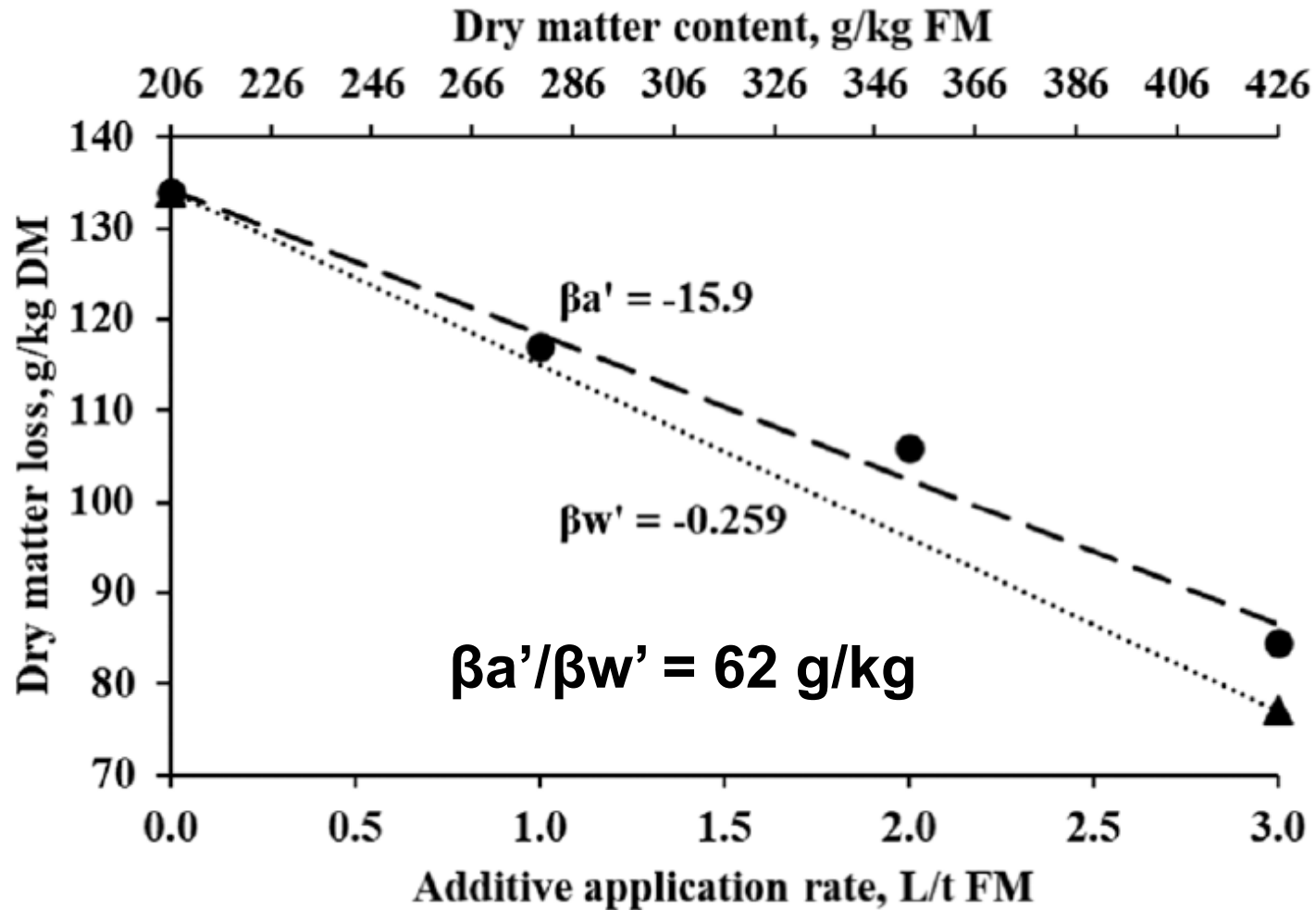
Source: Weissbach et al. (1974)

Applying the FC concept in tropical grass silage



Source: Carvalho et al. (2024)

FC can be enhanced by wilting or replaced with additive



Sodium nitrite based additive

Source: Bragatto et al. (2025)

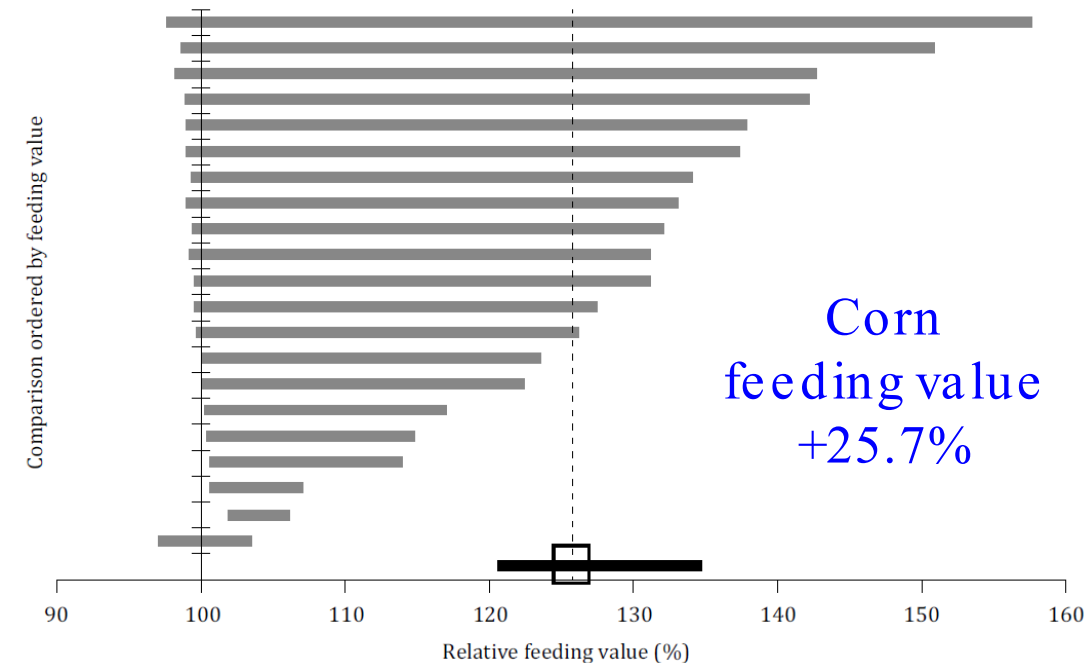
Improving corn grain feed value by ensiling



Finishing beef cattle meta-analysis

Item	Dry corn	Ensiled corn	P-value	Dif. %
ADG, kg/d	1.61	1.58	0.21	
DML, kg/d	10.3	8.85	<0.01	-14,1%
G:F	0.164	0.194	<0.01	+18,3%

Source: Jacovaci et al. (2021)



Final remarks



- There has been significant scientific progress on silage in tropical regions.
- Modern farms (large to small) are highly technified, efficient, and sustainable. Those farms are taking the market.
- Smallholders are very heterogeneous, including their cultural aspects (they need more policies, extension services, and cooperative actions).
- Silage market is still a window of opportunity in tropical areas.



Thank you for your attention