Brazilian beef cattle industry environmental and nutritional challenges and opportunities

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Ona Highlight – September 12th
Range Cattle Research & Education Center

People and facilities





Main topics

→ Where I come from?

→ Brazilian beef industry results

→ Research interest and main results

Main goal → Show beef cattle industry in Brazil and my Program's research in heat stress

This is Brazil


This is Brazil

But that is also Brazil

But that is also Brazil

Where I come from?

Where I come from?

Chimarrao or Mate
Special drink/tea

Churrasco
Brazilian BBQ

Where are we from?

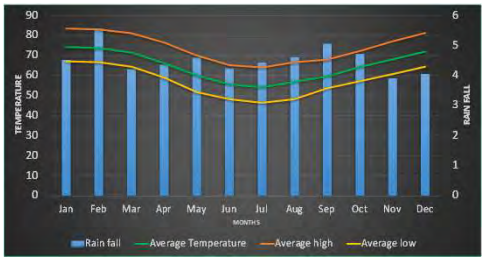
Biome Pampa = Lowland plains

Pampa biome

Paspalum notatum

It is a natural grassland biome with flat and fertile plains with sparse shrub and tree formations;

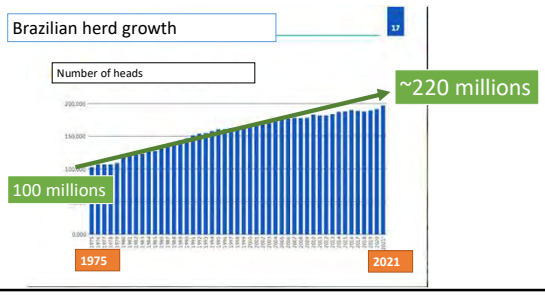
Southern Brazil



Beef industry in Brazil

Beef industry

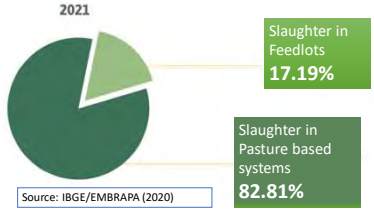
Brazilian herd growth



Beef Cattle Expantion

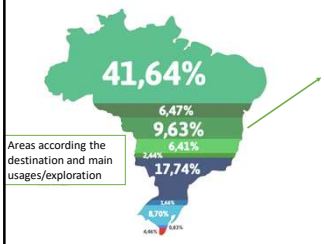
Source: IBGE (2020)

Beef industry



Source: IBGE/EMBRAPA (2020)

Sustainability/Environment



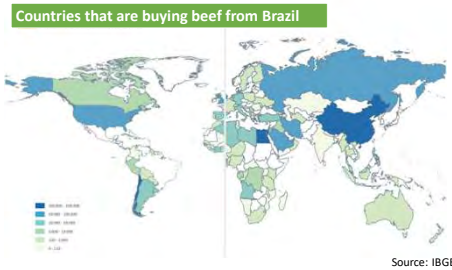
Areas according the destination and main usages/exploration

- Native vegetation/Forests/Amazon
- Permanent preservation areas
- Native vegetation with potential agriculture exploration
- Legal preservation areas
- Regenerate areas since 2003
- Pastures use exclusive
- Pastures with integrate usage
- Agriculture/Crops
- Reforestation
- Urban áreas/cities/rivers/swamp

Source: Athenagro. Conab. IBGE. INPE. EMBRAPA (2018)

Beef industry

Countries that are buying beef from Brazil



Source: IBGE/EMBRAPA 2020

Beef industry

Beef industry

Cow-calf operations

Cow-calf operations

Description

→~ 81 millions of beef cows in Brazil (~45 millions of calves produced yearly);

→~ 5.200.000 beef cows (~ 3.000.000 calves) in RS state;

→Spring/summer breeding season;

→22% of cow are bred by AI (fixed timed AI);

→Weaning age around 6-7 months

Challenges

→BCS at calving;

→Summer crops areas;

→Improve TAI protocol results (heat stress and nutrition);

Research interests and opportunities





Research interests and opportunities

- → Byproducts supplementation:
  - →Grapes/wine industry; sweet potato; tannins; olive oil industry.
- → Supplements and additives to ruminants
  - → yeast; methionine, enzymes.
- → Reproduction
  - →Timed AI programs; puberty and postpartum interval.

Researchs interests and opportunities

Heat stress in cattle



Heat stress

→The HS negatively impacts feed intake, milk yield, meat quality, physiological functions, and both male and female reproductive performance in cattle;

→ HS causes a reduction in feed intake, and it causes a change in animal's metabolism, because instead of using lipolytic pathways as source of glucose, heat-stressed animals increase skeletal-muscle protein catabolism, making amino acids playing an important role during this process (Baumgard and Rhoads, 2013);

→ Strategies to control HS can be either dietary supplementation like methionine, vitamin E, and betaine (Negrón-Pérez et al., 2019; Zhangh et al., 2020), as well as the provision of shade areas (Grandin, 2016; Izquierdo et al., 2023) aiming to mitigate the negative effects.

Heat stress issues

→ Reduce feed intake;

→ Causes changes in animal's metabolism → Increase energy mobilization;

→Decrease fertility and reproductive performance.

(Baumgard and Rhoads, 2013)

Heat stress issues

Strategies to control:

→ Dietary supplementation (methionine, vitamin E, and betaine);

→Shade areas (natural or artificial).

(Negrón-Pérez et al., 2019; Zhangh et al., 2020; Grandin, 2016; Izquierdo et al., 2023)

Heat stress

→ Food production must double by 2050 to meet the demand of world's population;

→ Beef consumption is projected to increase in 110% during this time;

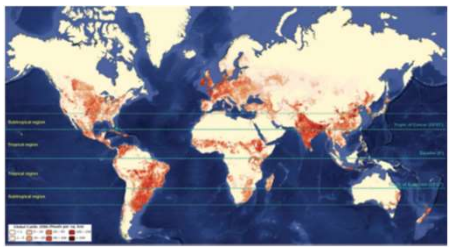
→ Around **70%** of this increase is expected to come from subtropical and tropical regions of the planet;

→ This regions contain more than **80%** of the world's cattle population;

→ Most of these areas are characterized as humid and high temperatures

(FAO, 2009; Cooke et al. 2020)

Heat stress



Cooke et al. 2020

Researchs interests and opportunities

Heat Stress in beef cattle

Does it a real problem in Brazil?

Can we modulate some responses?

Can we improve reproductive performance?

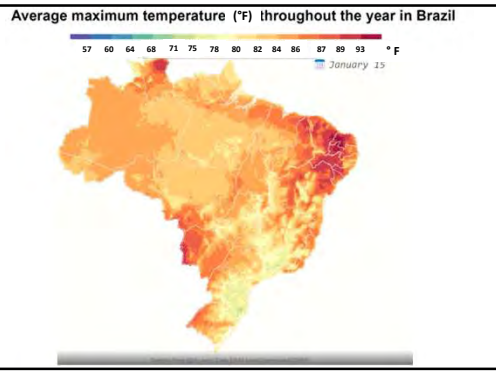
Heat stress

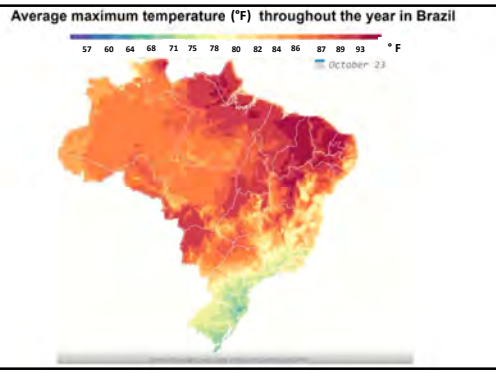
[redacted]

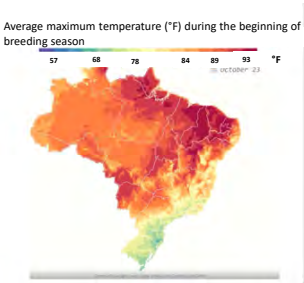
→ Methionine is an essential amino acid;

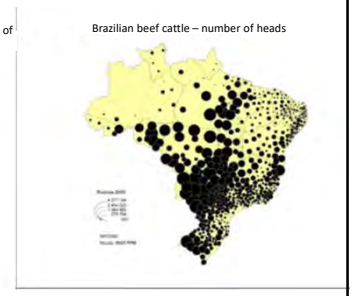
→ Studies in rats submitted to dietary methionine restriction showed several metabolic changes, such as increased body temperature, cell respiration rate, (Hasek et al., 2010; Patil et al., 2015);

→ Methionine helps in the protein synthesis, helping to prevent proteolysis (Del Vesco et al., 2015a) and participates in the process of heat sensitivity (Fricke et al., 2019).









Herd color is changing

Increasing *Bos taurus* percentage in Brazilian herd

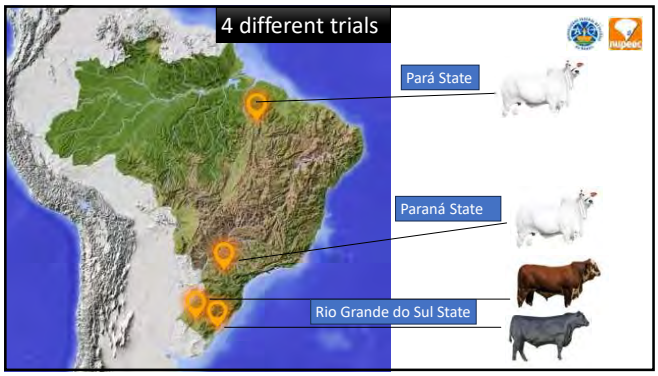
Herd color is changing

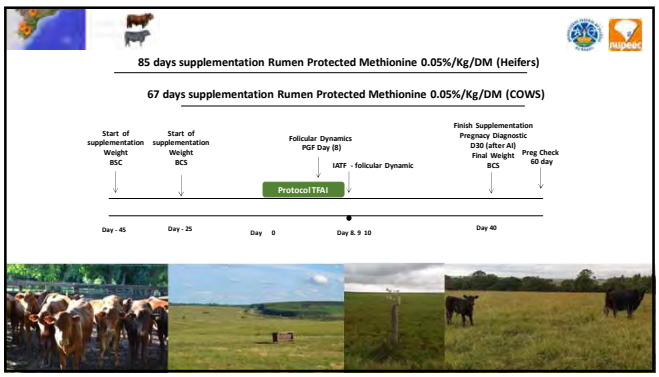
→ Chasing meat quality
→ Improving some characteristics

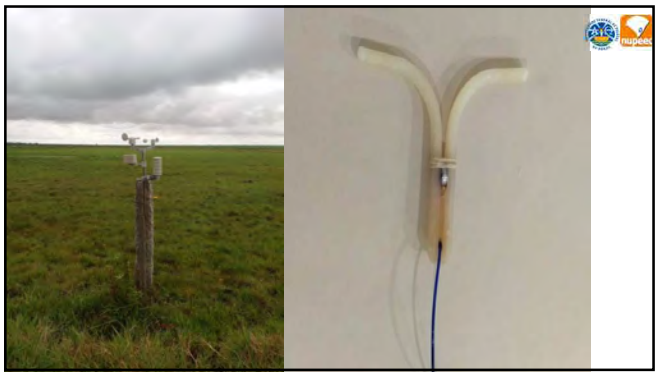
Heat stress and reproductive efficiency [redacted]

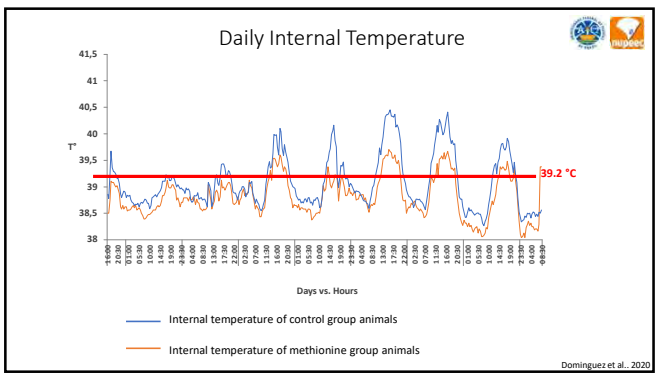
→ Majority of breeding season in Brazil is during spring/summer time

→ Increase FTAI results

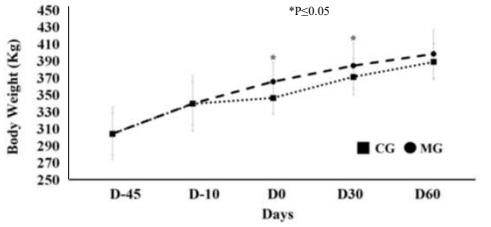



85 days supplementation Rumen Protected Methionine 0.05%/Kg/DM (Heifers)
67 days supplementation Rumen Protected Methionine 0.05%/Kg/DM (COWS)
Start of supplementation Weight BSC
Start of supplementation Weight BCS
Folicular Dynamics PGF Day (8)
IATF - folicular Dynamic
Protocol TFAI
Finish Supplementation Pregnacy Diagnostic D30 (after AI) Final Weight BCS
Preg Check 60 day
Day - 45
Day - 25
Day 0
Day 8, 9 10
Day 40



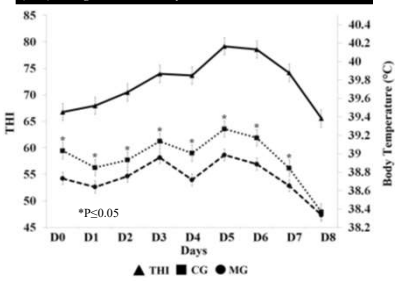

Daily Internal Temperature
41,5
41
40,5
40
39,5
39
38,5
38
T°
39.2 °C
Days vs. Hours
Internal temperature of control group animals
Internal temperature of methionine group animals
Dominguez et al., 2020

Body weight (Kg) in heifers of the control group (CG) and methionine group (MG) during the experimental period



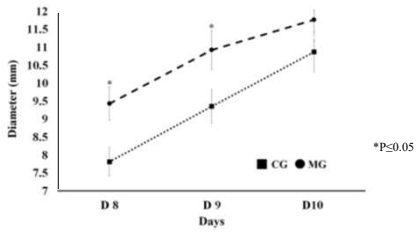
Dominguez et al. 2020

Body temperature (°C) in heifers of the control group (CG) and methionine group (MG) and the temperature-humidity index (THI) during the first nine days of FTAI



Dominguez et al. 2020

Follicle diameter (mm) in heifers of the control group (CG) and methionine group (MG) during the last three days in the fixed-time artificial insemination (FTAI)



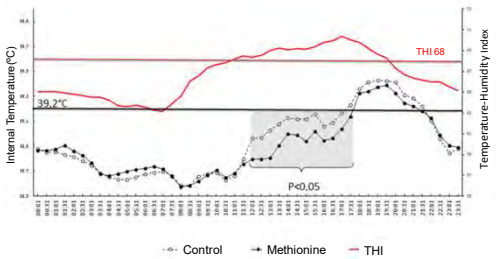
Dominguez et al. 2020

Pregnancy rate at 30 and 60 days after TAI of heifers from control and methionine group

	Pregnancy Rate (%) D30		P	Pregnancy Rate(%) D60		P
	Control	Smartamine		Control	Smartamine	
Pregnancy	39.5 (19/48)	43.3 (22/52)	P>0.05	79.1 (38/48)	76.9 (40/52)	P>0.05

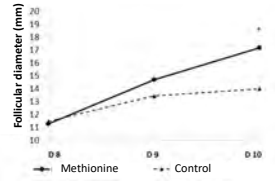
Dominguez et al., 2020

Internal temperature during the FTAI protocol of methionine and control group



Farias et al. 2021

Follicle diameter (mm) in cows of the methionine and control groups during the last three days in the fixed-time artificial insemination (FTAI)



Farias et al. 2021

Pregnancy rate at 30 and 60 days after TAI of cows from control and methionine group

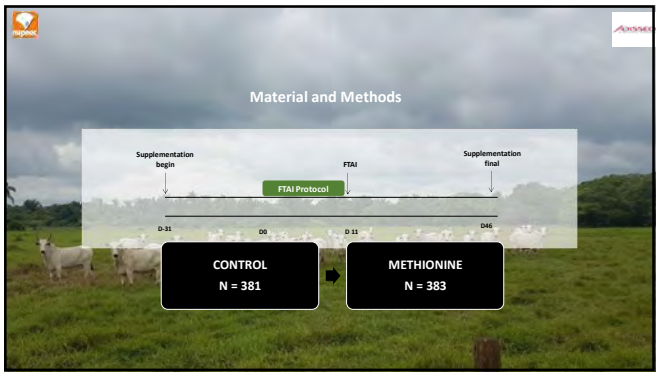
Pregnancy diagnosis	Methionine Group	Control Group	P
30 days	67.1% (47/70)	58.9% (43/73)	0.30
60 days	77.1% (54/70)	68.5% (50/73)	0.24
Pregnancy loss between 30 and 60 days	6.4% (3/47)	11.6% (5/43)	0.38

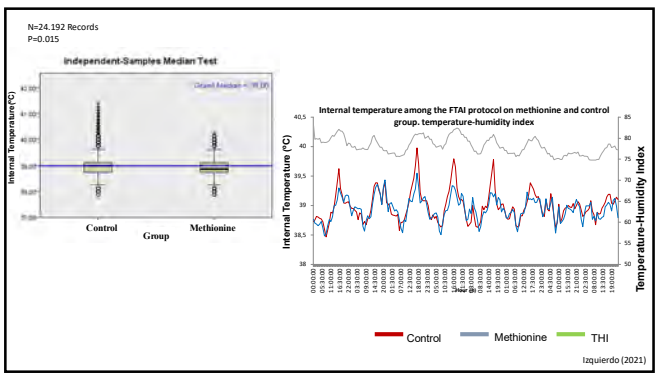
Farias et al. 2021

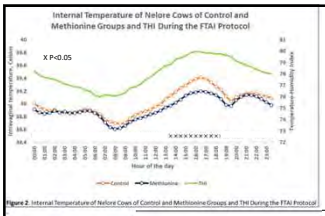
Trial 3
PARÁ - Brazil
2019/2020

- Nelore cows
- North of Brazil

Izquierdo (2021)


Material and Methods
Supplementation begin
FTAI
Supplementation final
FTAI Protocol
D-31
D0
D 11
D46
CONTROL
N = 381
METHIONINE
N = 383


N=24.192 Records
P=0.015
Independent-Samples Median Test
Internal Temperature(°C)
Control
Methionine
Group
Internal temperature among the FTAI protocol on methionine and control group. temperature-humidity index
Internal Temperature (°C)
Temperature-Humidity Index
Control
Methionine
THI
Izquierdo (2021)



Pregnancy rates of CG and MG during the four replicates

Repetition	1		2		3		4	
Group	Control	Methionine	Control	Methionine	Control	Methionine	Control	Methionine
Pregnancy Rate	63.53% (54/85)	55.00% (55/100)	61.86% (60/97)	53.00% (53/100)	67.74% (63/93)	67.82% (59/87)	66.04% (70/106)	65.63% (63/96)

No differences

Izquierdo (2021)

Methionine may have a positive impact on reproduction, however we need to understand better how this modulation happen

Next steps

[redacted]

→Better understanding about methionine role during the breeding season;

→Overall understanding of heat stress effects in *Bos indicus* cattle in Brazil

→ Increase interaction with Dr. Moriel and his Program: have students coming, more researches in Brazil, exchange information, working together.

Acknowledgments

Acknowledgments