Plataforma de Otimização Econômica (lucro máximo) e Minimização do Impacto Ambiental o exemplo do PecPlace

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ESALQ/USP

ESALQ
ESCOLA SUPERIOR DE AGRICULTURA
LUIZ DE QUEIROZ
USP

RLM
Ração de Lucro Máximo

DNA USP

Futuro

Presente

Passado

1) Sistema de Detergentes (Peter Van Soest) 60’s

Use of Detergents in the Analysis of Fibrous Feeds. IV. Determination of Plant Cell-Wall Constituents

By P. J. Van SOEST and R. H. WINE (Animal Husbandry Research Division, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Md. 20705)

A rapid procedure for determining cell-wall constituents of plants consists of the determination of the fiber insoluble in neutral detergent and is applicable to all feedstuffs. The standardization of the method is based on a nutritional concept which defines fiber as insoluble vegetable matter which is indigestible by proteolytic and diastatic enzymes and which cannot be utilized except by microbial fermentation in the digestive tracts of animals.

portion of the feed for its own maintenance, and only some of the fermentation products and the organisms themselves may be utilized by the host animal.

Fiber can be defined nutritionally as the insoluble organic matter indigestible by animal enzymes (1). The residue left after extraction with water and solvents, followed by pepsin and amylase digestion, has been recommended as the basis for the determination of plant cell-wall constituents (2).

2) Sistema Californiano de Energia Líquida (Lofgreen & Garrett) 70's

Reading 27

Reprinted from JOURNAL OF ANIMAL SCIENCE, Vol. 27, No. 3, May 1968.

39 Sheridan Avenue, Albany, New York 12210

A SYSTEM FOR EXPRESSING NET ENERGY REQUIREMENTS AND FEED VALUES FOR GROWING AND FINISHING BEEF CATTLE

G. P. LOFGREEN AND W. N. GARRETT
University of California, Davis [1]

EARLY in 1963 the authors introduced a net energy system designed for use in the growing and finishing phase of the beef cattle industry (Lofgreen, 1963a, b, c). The system separated the requirements for maintenance from that for body weight gain and expressed weight gain does not deviate significantly from linearity. This means that the partial net energy of a feed when utilized for weight gain above maintenance can be considered to be constant. The partial net energy for maintenance of that quantity of feed needed to

3) Sistema Proteina Metabolizável (Burroughs & Mertens) 70's

Evaluation of Protein Nutrition by Metabolizable Protein and Urea Fermentation Potential[1,2]

W. BURROUGHS, D. K. NELSON, and D. R. MERTENS
Department of Animal Science
Iowa State University, Ames 50010

Abstract

Metabolizable protein and selected metabolizable amino acid requirements for lactating cows were described, and tentative values were established for different yields of milk. A new expression, "urea fermentation potential of feeds," describes urea use in lactation rations for partial satisfaction of protein and amino acid requirements. Tentative urea fermentation values were established for the more common cattle feedstuffs. Four lactation rations were formulated with different fermentation values to illustrate the variable feeding value of urea in sat- types of rations in which variable urea feeding values were predicted by the new system. In addition to predicting variable feeding values of urea, the MP system was designed to recognize variable degradation of natural proteins as well as variable synthesis of microbial proteins in rumen fermentation. Variable degradation and synthesis of protein in the rumen were used to predict the amount of amino acids which can be absorbed post-ruminally and used to meet the protein nutrition of cattle.

At this early stage, the system is based on limited data; additional research is needed for refinement. Nevertheless, it even now seems more valuable in evaluating urea-containing

4) Cornell Net Carbohydrate and Protein System (Fox, D.G.), 80's

A Net Carbohydrate and Protein System for Evaluating Cattle Diets: III. Cattle Requirements and Diet Adequacy[1]

D. G. Fox*, C. J. Sniffen*,[2], J. D. O'Connor*,[3], J. B. Russell*,†, and P. J. Van Soest*

*Department of Animal Science, Cornell University, Ithaca, NY 14853 and †U.S. Dairy Forage Research Center, ARS, USDA, Madison, WI 53706 and U.S. Plant, Soil, and Nutrition Laboratory, Ithaca, NY 14853

ABSTRACT: The Cornell Net Carbohydrate and Protein System (CNCPS) has equations for predicting nutrient requirements, feed intake, and feed utilization over wide variations in cattle (frame size, body condition, and stage of growth), feed carbohydrate and protein fractions and their digestion and passage rates, and environmental conditions. Independent data were used to validate the ability of the CNCPS to predict responses compared to National Research Council (NRC) systems. With DMI in steers, the CNCPS had a 12% lower standard error of the Y estimate ($S_{y \cdot x}$) and three percentage units less bias than the NRC system. For DMI in heifers, both systems had a similar $S_{y \cdot x}$ but the NRC had four percentage units less bias. With lactating dairy cows' DMI, the CNCPS had a 12% lower $S_{y \cdot x}$. Observed NE_m requirement averaged 5% under NRC and 6% under CNCPS predicted values at temperatures above 9°C but were 18% over NRC and 9% under CNCPS at temperatures under 9°C. Energy retained was predicted with an R^2 of .80 and .95 and a bias of 8 and 4% for the NRC and CNCPS, respectively. Protein retained was predicted with an R^2 of .75 and .85 with a bias of 0 and –1% for NRC and CNCPS, respectively. Biases due to frame size, implant, or NE_g were small. Body condition scores predicted body fat percentage in dairy cows with an R^2 of .93 and a $S_{y \cdot x}$ of 2.35% body fat. The CNCPS predicted metabolizable protein allowable ADG with a bias of 1.6% with a $S_{y \cdot x}$ of .07 kg compared to values of –30% and .10 kg, respectively for the NRC system.

Key Words: Cattle, Requirements, Nutrition, Models

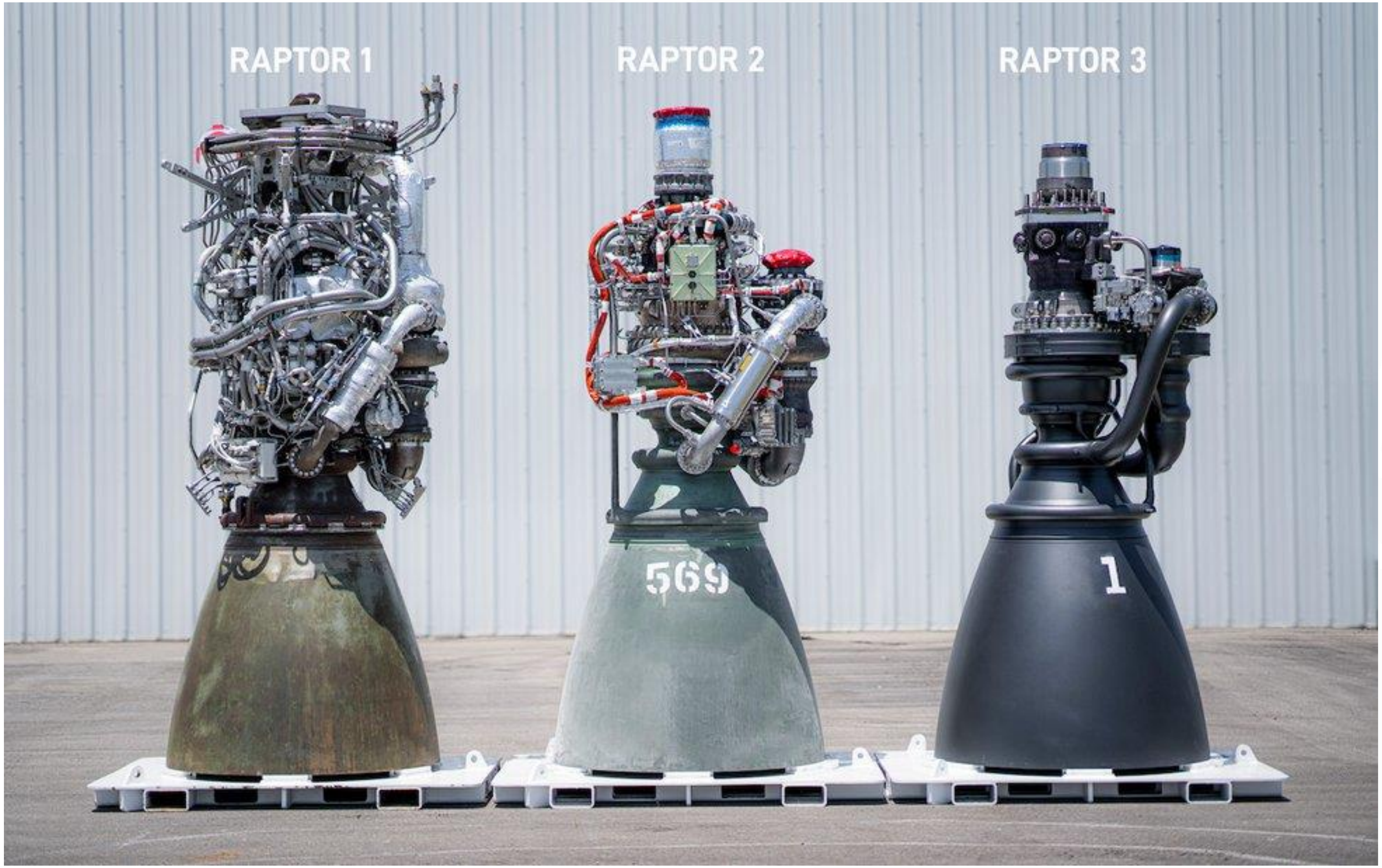
História do RLM

"Standing on the shoulders of Giants", I. Newton

História do CNCPS e do RLM

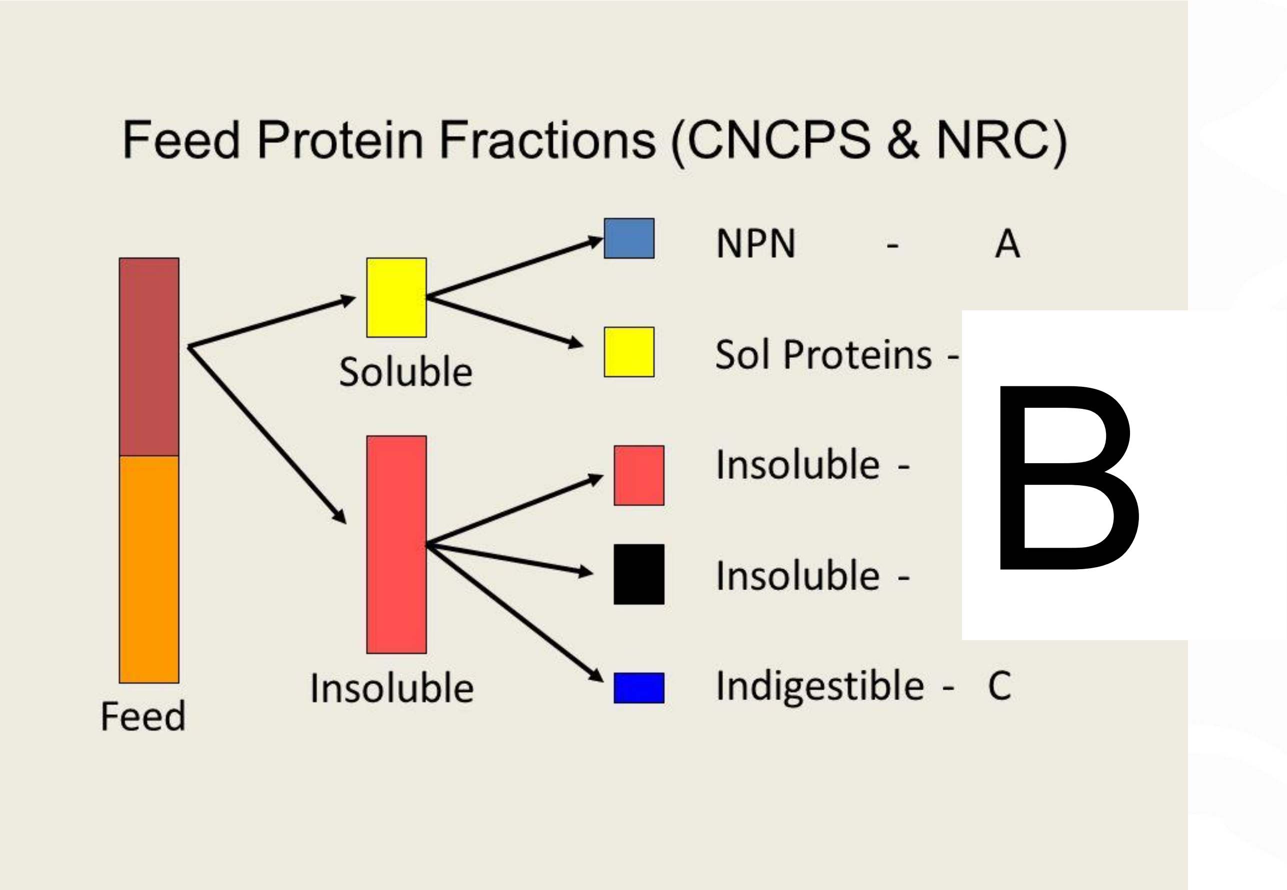
História do RLM

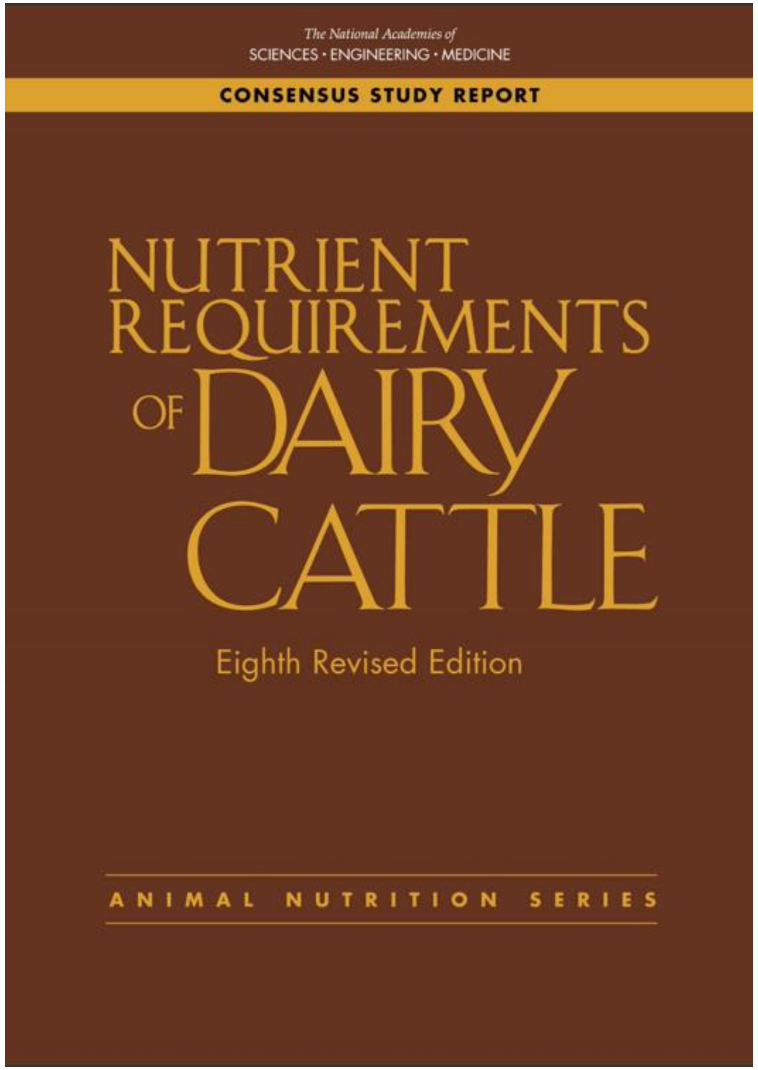
História do RLM



30.000 US$/KG → 1.500 US$/kg

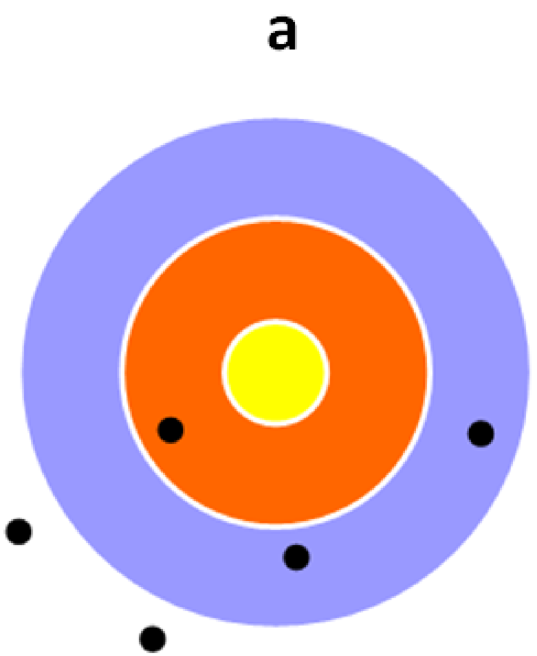
Algoritmos, Laboratórios e o Campo





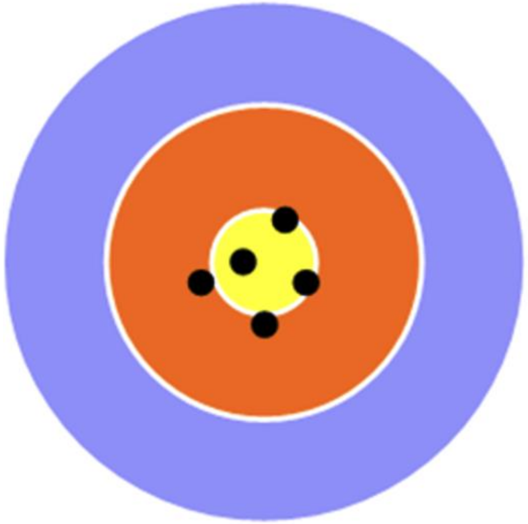
RLM Ração de Lucro Máximo

Qualidade dos Softwares de Exigências e Formulação

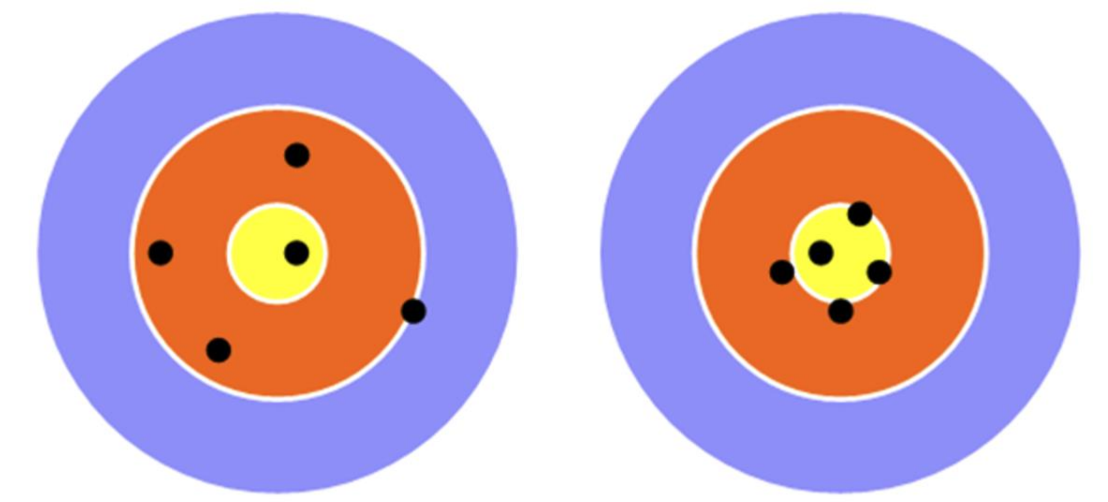


PRECISÃO: NÃO
EXATIDÃO: NÃO

Acurácia x Precisão

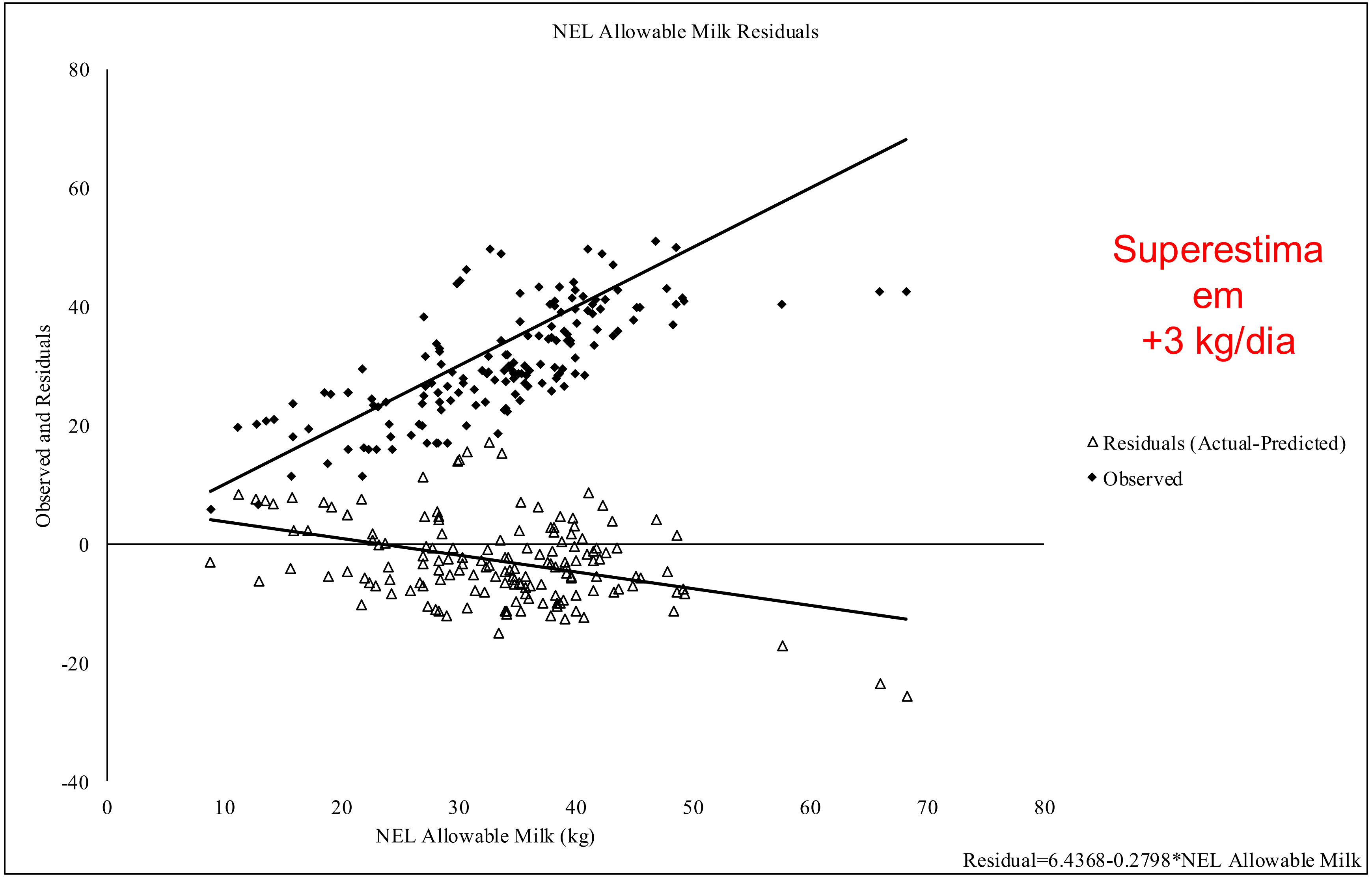


Acurácia x Precisão

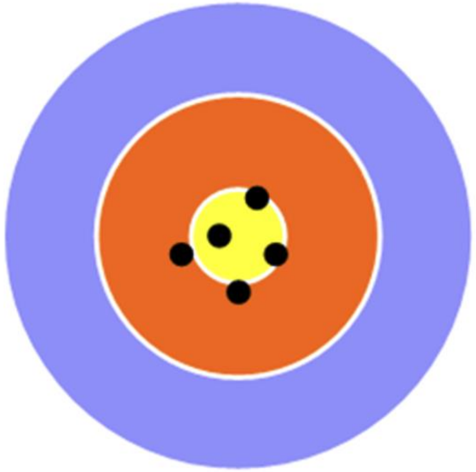


Predição da produção de leite pelo NRC 2001

Mark Hannigan, com.pessoal



Superestima
em
+3 kg/dia



Modelo Adotado pelo RLM

J. Dairy Sci. 98:4012–4029
http://dx.doi.org/10.3168/jds.2014-8995

Multivariate and univariate analysis of energy balance data from lactating dairy cows

L. E. Moraes,* E. Kebreab,* A. B. Strathe,† J. Dijkstra,‡ J. France,§ D. P. Casper,# and J. G. Fadel*[1]
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†Department of Veterinary Clinical and Animal Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, 1870 Frederiksberg C, Denmark
‡Animal Nutrition Group, Wageningen University, PO Box 338, 6700 AH Wageningen, the Netherlands
§Centre for Nutrition Modelling, Department of Animal and Poultry Science, University of Guelph, N1G 2W1, ON, Canada
#Dairy Science Department, South Dakota State University, Brookings 57007

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Exigência de Mantença

- ✓ Exigência Energia Mantença (sem atividade, Mcal/dia)

$$EL_{mant} = [(PV - P_{conc})^{0,75} \times 0,080]$$

EL_{mant} – exigência energia de mantença (Mcal/)
P_{conc} – peso do concepto (kg)
PV – peso vivo do animal (kg)

Exigência de Mantença

- ✓ Exigência Energia Mantença (sem atividade, Mcal/dia)

$$EL_{mant} = [(PV - P_{conc})^{0,75} \times 0{,}100]$$

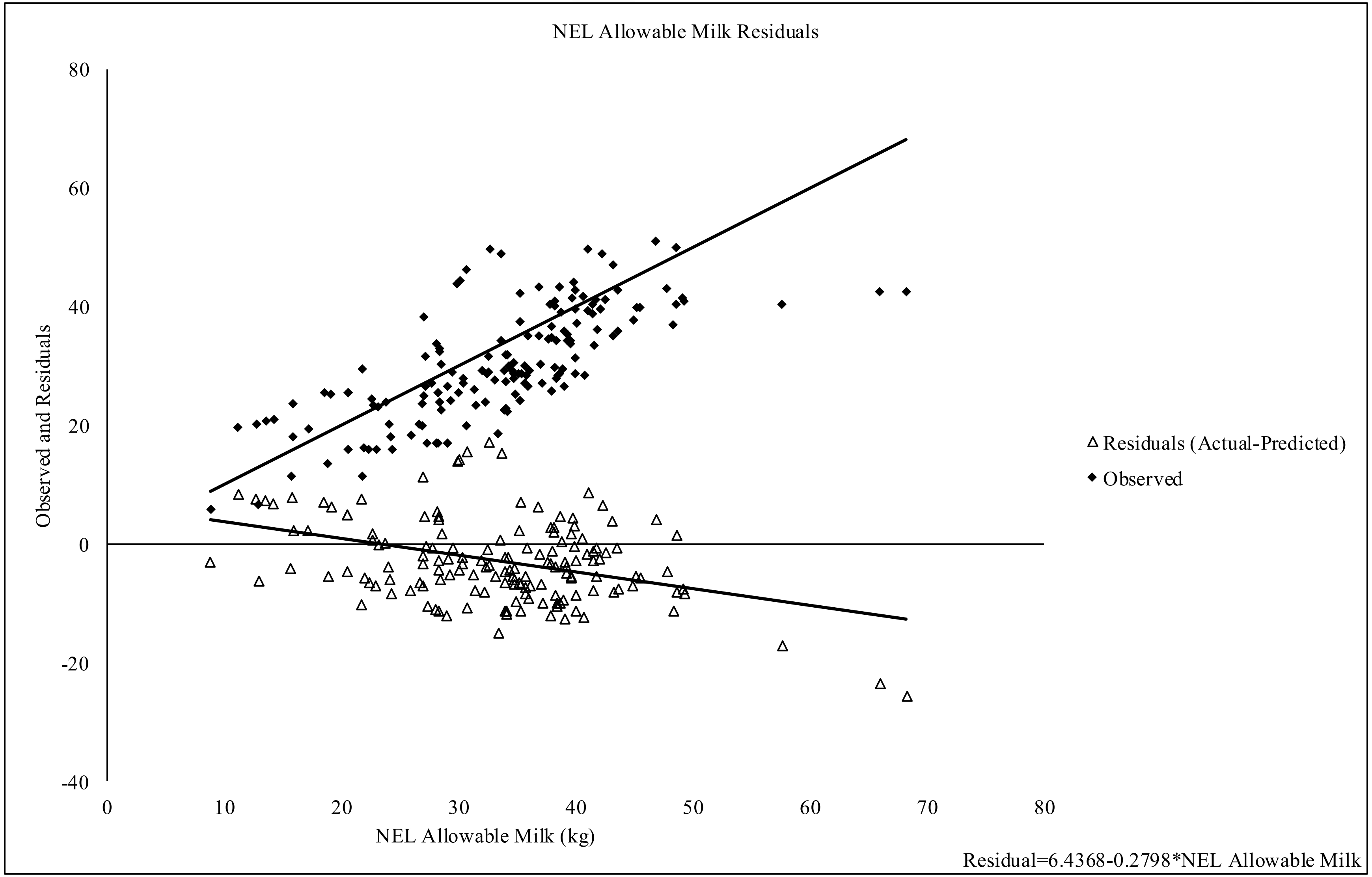
EL_{mant} – exigência energia de mantença (Mcal/)
P_{conc} – peso do concepto (kg)
PV – peso vivo do animal (kg)

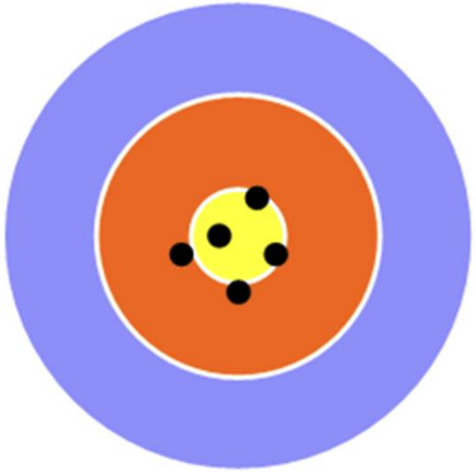
RLM
Ração de Lucro Máximo

RLM LEITE
em 2016

Predição da produção de leite pelo NRC 2001

Mark Hannigan, com.pessoal





B.Weiss no Formuleite 2018...

Are NEL Requirements Correct?

Is Maintenance Requirement Too Low ?

Current: Maint = $0.08W^{0.75}$

Some data: 0.09 to $0.12W^{0.75}$

Variable over lactation ?

Bigger pens, standing cows, etc.

Modern Holstein Maintenance:
0.09 to 0.10 $W^{0.75}$

Exigência de Mantença NASEM (2021)

Maintenance Requirements

The NEL requirement for maintenance (NELmaint) of adult dairy cattle is

$$\text{NELmaint (Mcal/d)} = 0.10 \times \text{BW kg}^{0.75} \quad \text{(Equation 3-13)}$$

Based on Moraes et al. (2015), this value would have a 95 percent confidence interval of about ±0.06. This is a substantial increase from previous versions and adds about 2.5 Mcal of NEL to the energy requirement of the average Holstein cow. Given the intensive selection for milk production in dairy cattle over the past 50 years with average milk production now three times that of the 1960s, it seems reasonable that modern dairy cows have metabolic rates for maintenance that are greater than they were 50 years ago.

Fonte: NASEM (2021)

Para vacas **zebuínas** e **mestiças**, numa nova tropicalização do modelo, a mantença é estimada usando o coeficiente de **0,09 Mcal/kg^{0,75}**

Ração de Lucro Máximo

Desenvolvimento do submodelo de bezerras e novilhas

Animal, page 1 of 10 © The Animal Consortium 2016
doi:10.1017/S1751731116000975

animal

Evaluation of nutrition models to estimate performance of young dairy calves: a meta-analytical study under tropical conditions

V. L. Souza[1†], J. K. Drackley[2], R. Almeida[3], C. M. M. Bittar[1], T. Z. Albertini[1], S. Y. Morrison[2] and D. P. D. Lanna[1]

[1]Department of Animal Science, University of São Paulo (ESALQ-USP), Piracicaba, São Paulo, 13418-900, Brazil; [2]Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, 61801, USA; [3]Department of Animal Science, Federal University of Paraná, Curitiba, Paraná, 80035-050, Brazil

animals

MDPI

Article

Feed Intake of Growing Dairy Heifers Raised under Tropical Conditions: A Model Evaluation Using Meta-Analysis

Marcos Busanello [1,*], Debora Gomes de Sousa [1], Filipe Araújo Canedo Mendonça [1], Veridiana Lourenço Daley [2], Rodrigo de Almeida [3], Carla Maris Machado Bittar [1] and Dante Pazzanese Duarte Lanna [1]

RLM Ração de Lucro Máximo

Peso corporal de diferentes grupamentos raciais

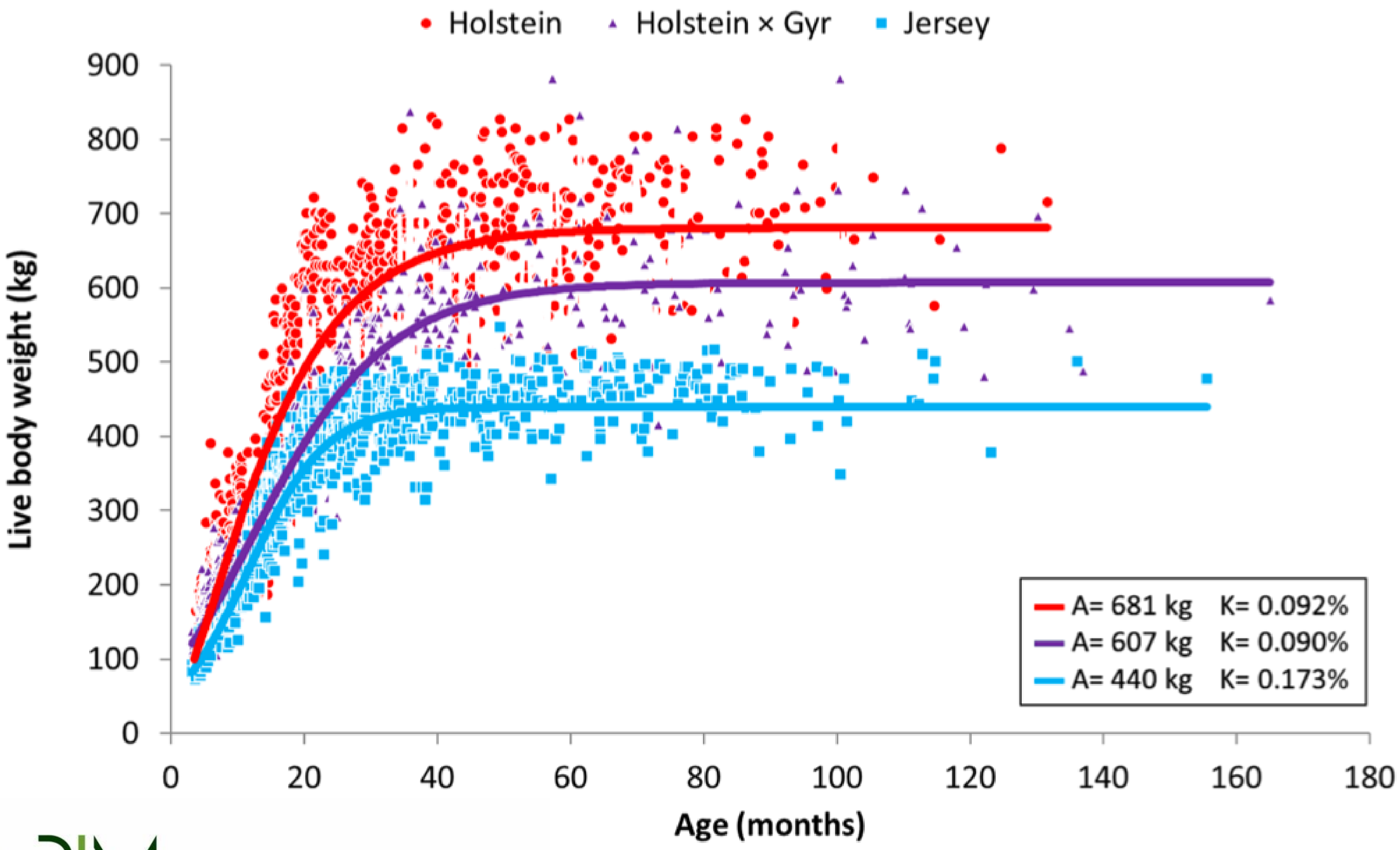
J. Dairy Sci. 105:3222–3233
https://doi.org/10.3168/jds.2021-21197

Body growth of replacement dairy heifers from 3 distinct genetic groups from commercial Brazilian dairy herds

Marcos Busanello,[1]* Debora G. Sousa,[1] Milaine Poczynek,[2] Rodrigo de Almeida,[2] Carla M. M. Bittar,[1] Filipe A. C. Mendonça,[1] and Dante P. D. Lanna[1]
[1]Department of Animal Science, "Luiz de Queiroz" College of Agriculture, University of São Paulo, Piracicaba, São Paulo, 13418-900, Brazil
[2]Department of Animal Science, Federal University of Paraná, Curitiba, Paraná, 80035-050, Brazil

RLM Ração de Lucro Máximo

Peso corporal de diferentes grupamentos raciais



Ração de Lucro Máximo

Busanello et al. (2022)

Nova Equação de Predição de Consumo de MS no NRC (2021)

Updated equation using animal factors only

J. Dairy Sci. 102:7948–7960
https://doi.org/10.3168/jds.2018-16176

Updating predictions of dry matter intake of lactating dairy cows

R. A. de Souza, R. J. Tempelman, M. S. Allen, and M. J. VandeHaar*
Department of Animal Science, Michigan State University, East Lansing 48824

$$\text{DMI (kg/d)} = [(3.7 + \text{Parity} \times 5.7) + 0.305 \times \text{MilkE (Mcal/d)} + 0.022 \times \text{BW (kg)} + (-0.689 + \text{Parity} \times -1.87) \times \text{BCS}] \times [1 - (0.212 + \text{Parity} \times 0.136) \times e^{(-0.053 \times \text{DIM})}]$$

where parity = the proportion of multiparous cows
(1 if the animal is multiparous and 0 if primiparous)

Ração de Lucro Máximo

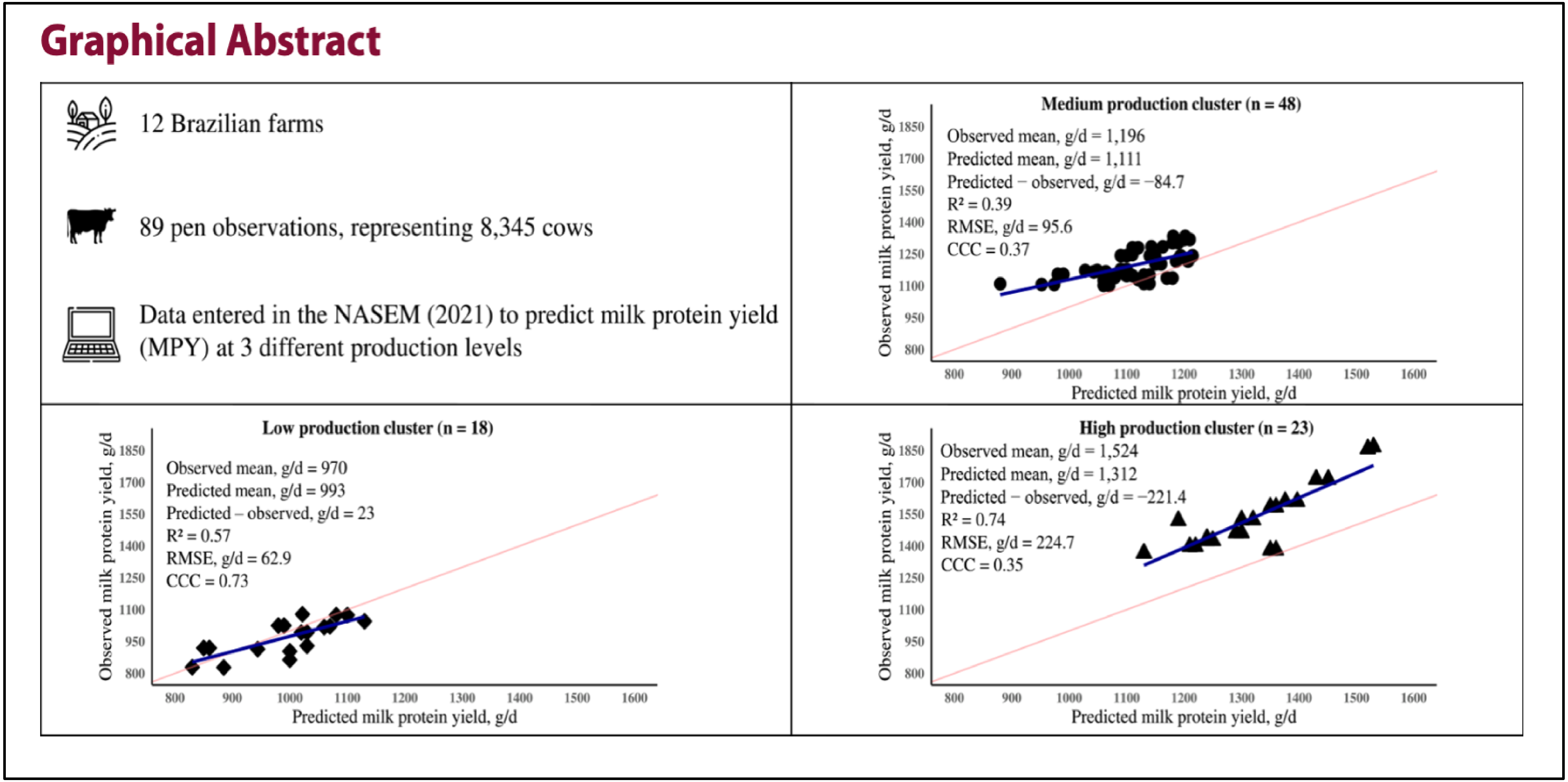
De Souza et al. (2019)

JDS Communications®
2025; 6:65–68

https://doi.org/10.3168/jdsc.2024-0636
Short Communication
Animal Nutrition and Farm Systems

Evaluation of the National Academies of Sciences, Engineering, and Medicine (NASEM) milk protein yield prediction model with data from Brazilian commercial farms

Jorge Henrique Carneiro,[1] João Pedro Andrade Rezende,[1] Rodrigo de Almeida,[2] and Marina de Arruda Camargo Danes[1]*



Fonte: Carneiro et al. (2025)

RLM Corte

Acurácia

x

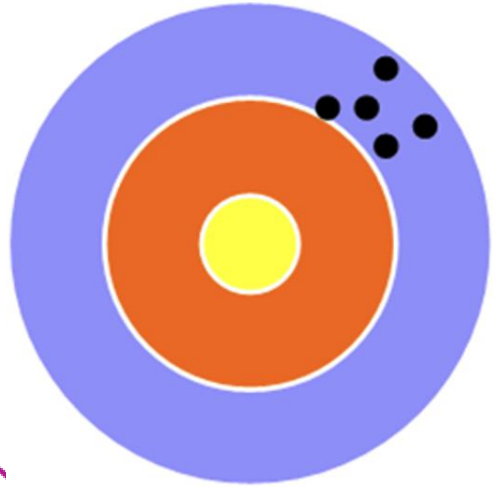
Precisão

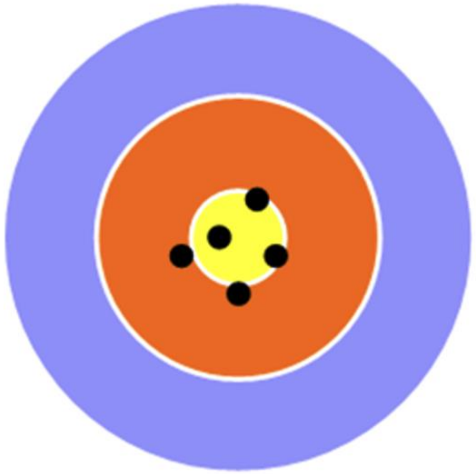
Consumo X Oferta

Desempenho | Níveis Nutricionais

Econômico (ofertado)	
Custo total do ganho	287.70 $/@
Custo alimentar do ganho	229.15 $/@
Custo diário total	17.69 $/cab/d
Custo diário alimentar	14.09 $/cab/d
Dias de Confinamento	0 d

Animal	
Ganho (peso vivo)	1.77 kg/d
Ganho (peso em jejum)	1.68 kg/d
	8.89 kg MS/d
Consumo	14.23 kg MO/d
	2.11 % PVj
	9.46 kg MS/d
Oferta	15.14 kg MO/d





Ração de Lucro Máximo

RLM CORTE
em 2006

Validações dos Modelos e Qualidade dos Dados

VALIDAÇÃO DE UM MODELO MATEMÁTICO DE EXIGÊNCIAS NUTRICIONAIS E ESTIMATIVA DO DESEMPENHO

Master of Science: Beatriz Motta Hoffmann

2003-2006

21 experimentos

99 tratamentos

496 lotes

15 dietas

92.948 animais

A explosão nos desempenhos

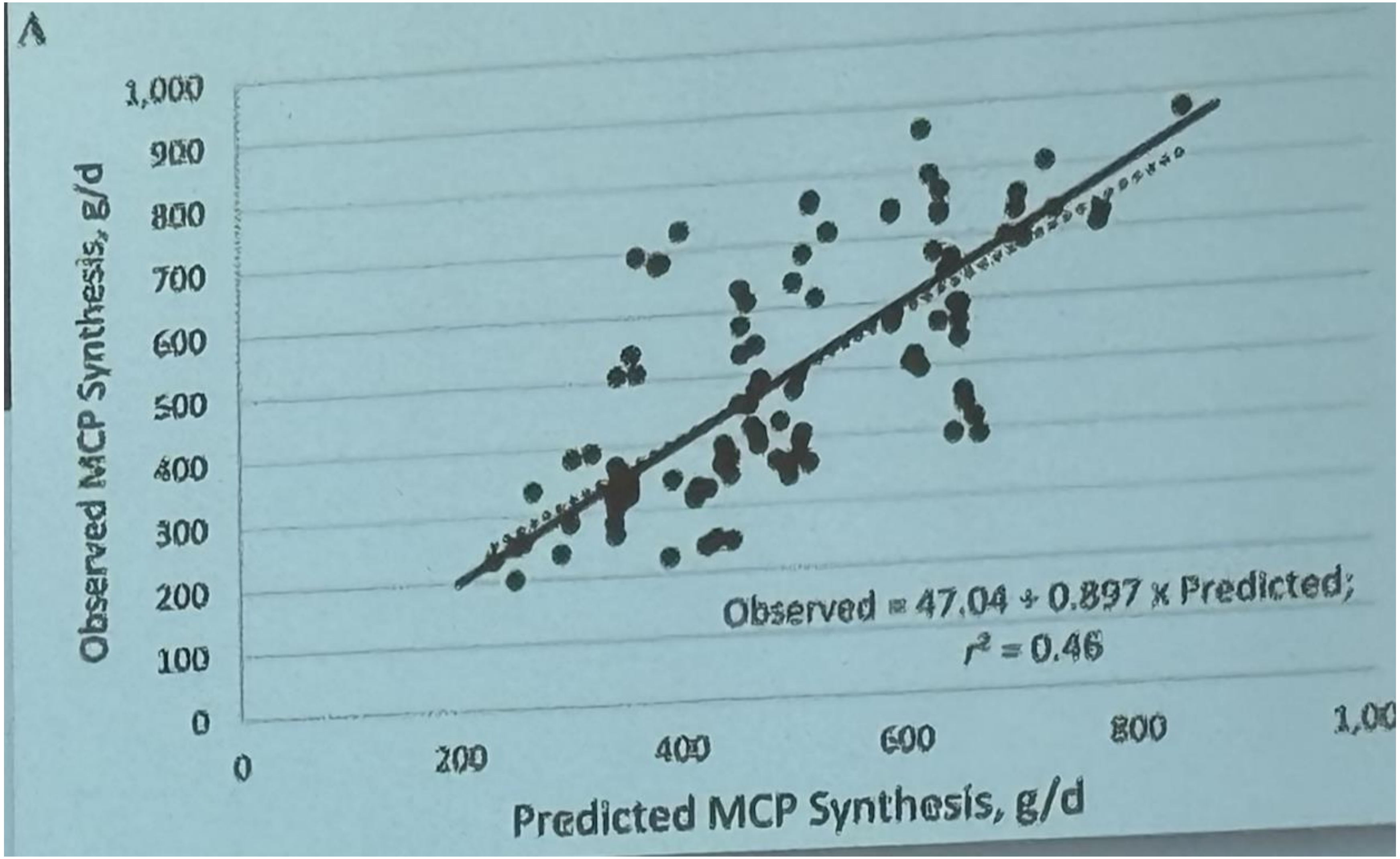
1. **Subestimativa das perdas endógenas fecais.**

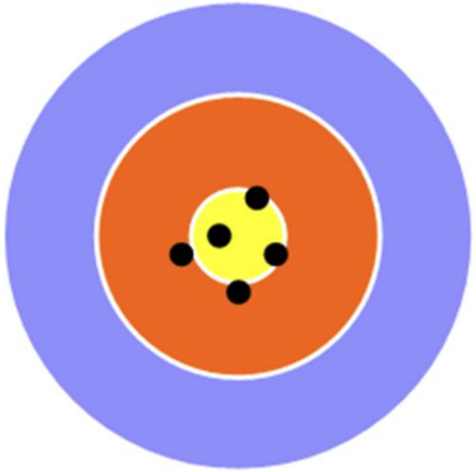
2. **Crescimento Compensatório (+ proteína met.)**

3. **Alta taxa de passagem e alta exigência de PDR**

De 1994 até 1998, aumentos de ganho de peso sem precedentes.

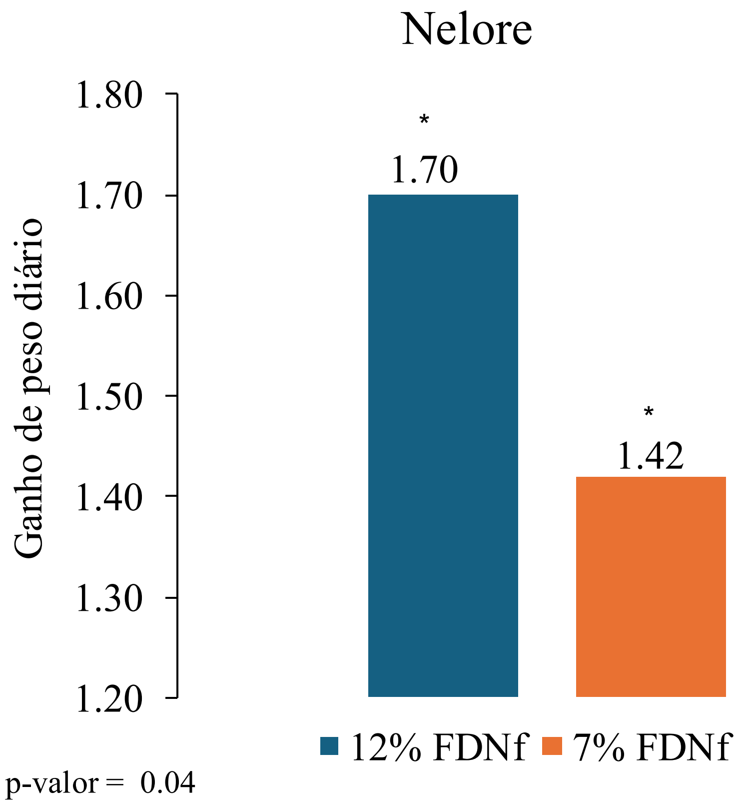
Exigências de PDR, RLM x NASEM

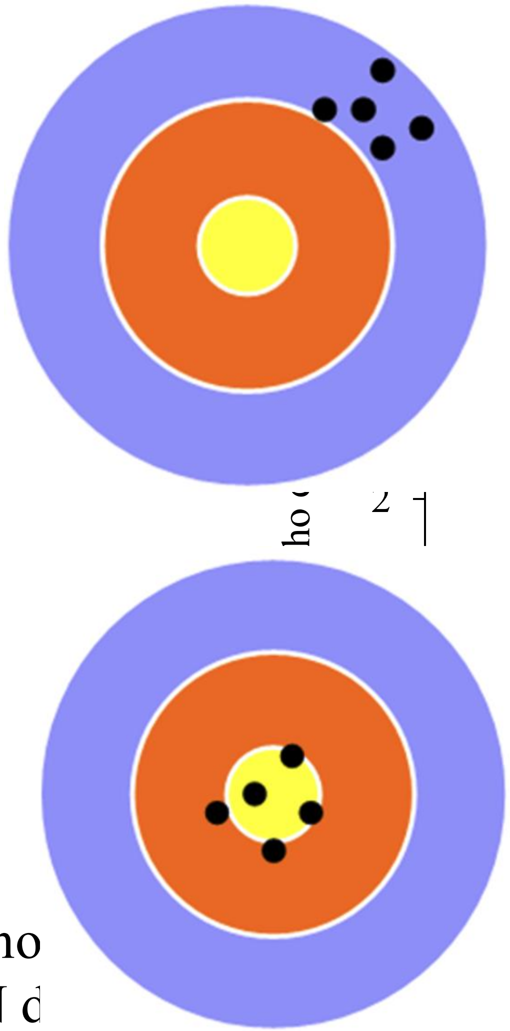


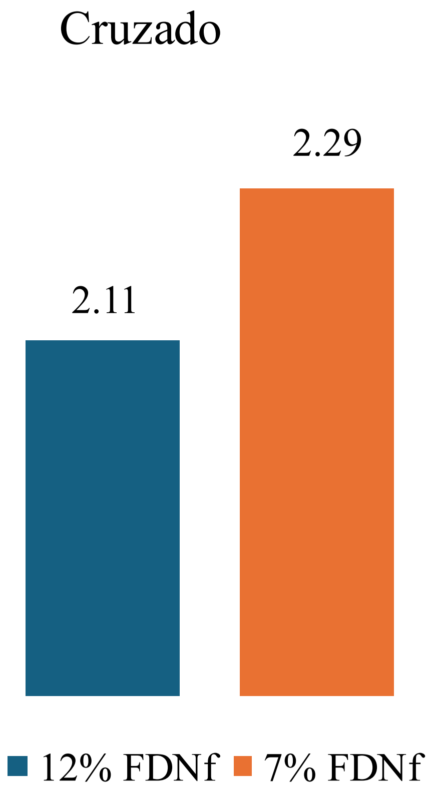


DiLorenzo, 2024

Resultados preliminares



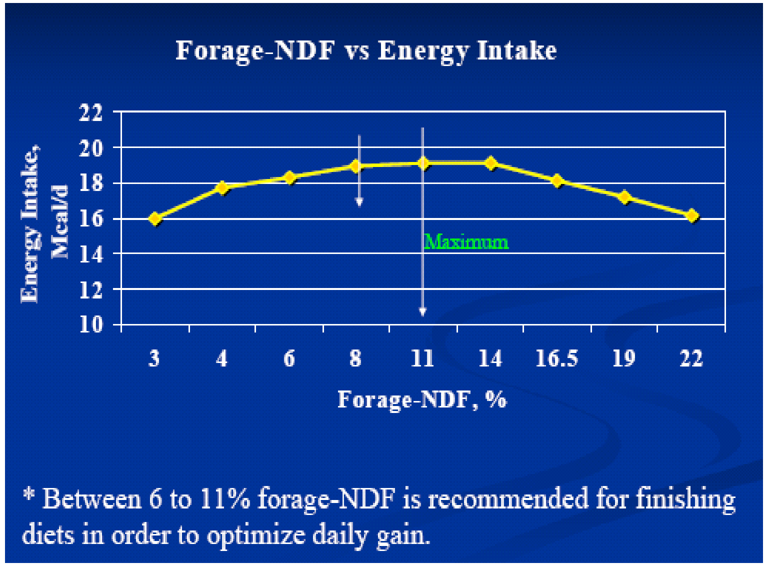


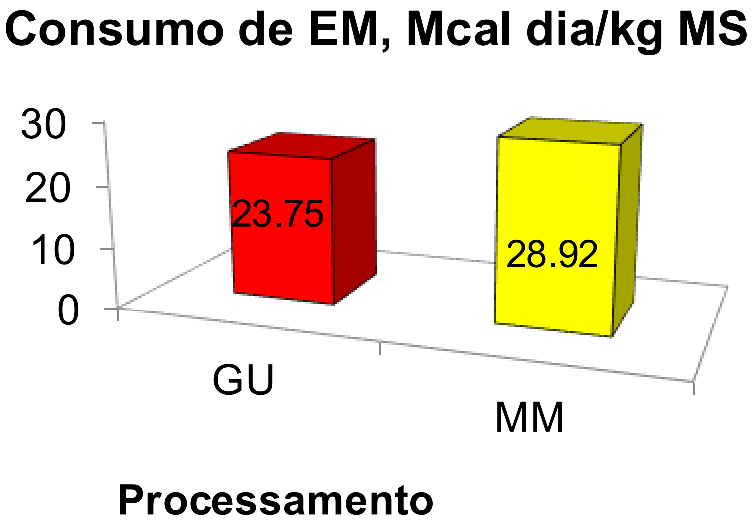


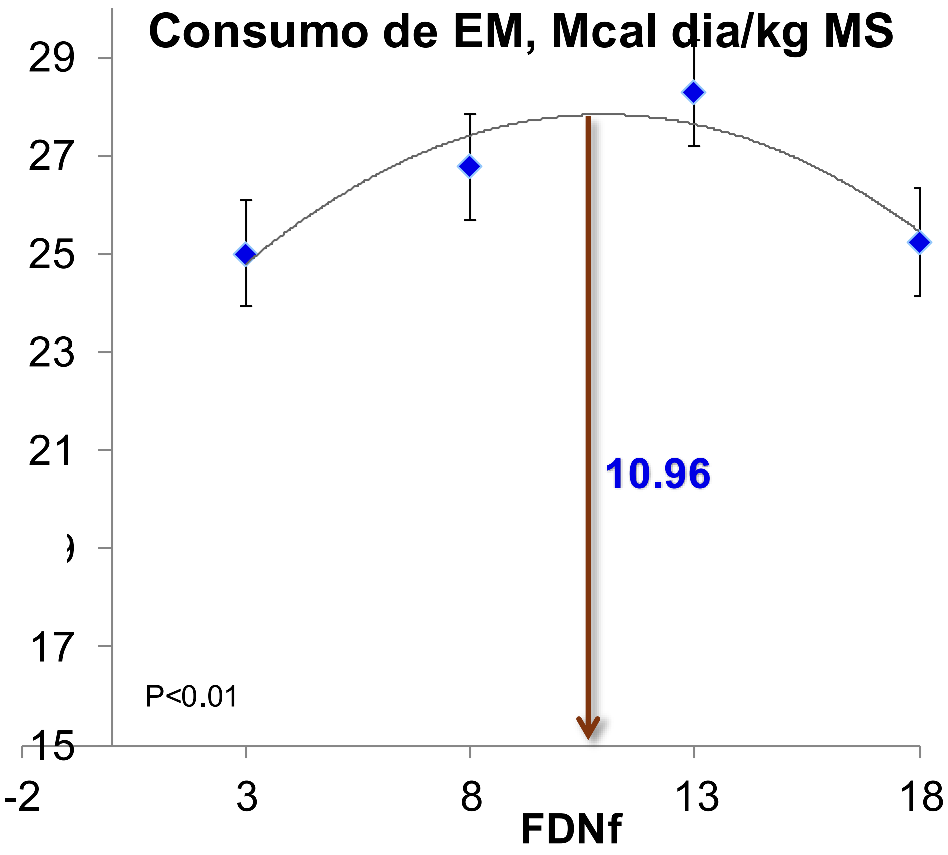
Gráficos 5 e 6: Ganho de peso de bovino m confinamento alimentado com dietas contendo diferentes percentuais de FDN d

Dados não publicados (Souza e Lanna, 2024)

Exigência de FIBRA

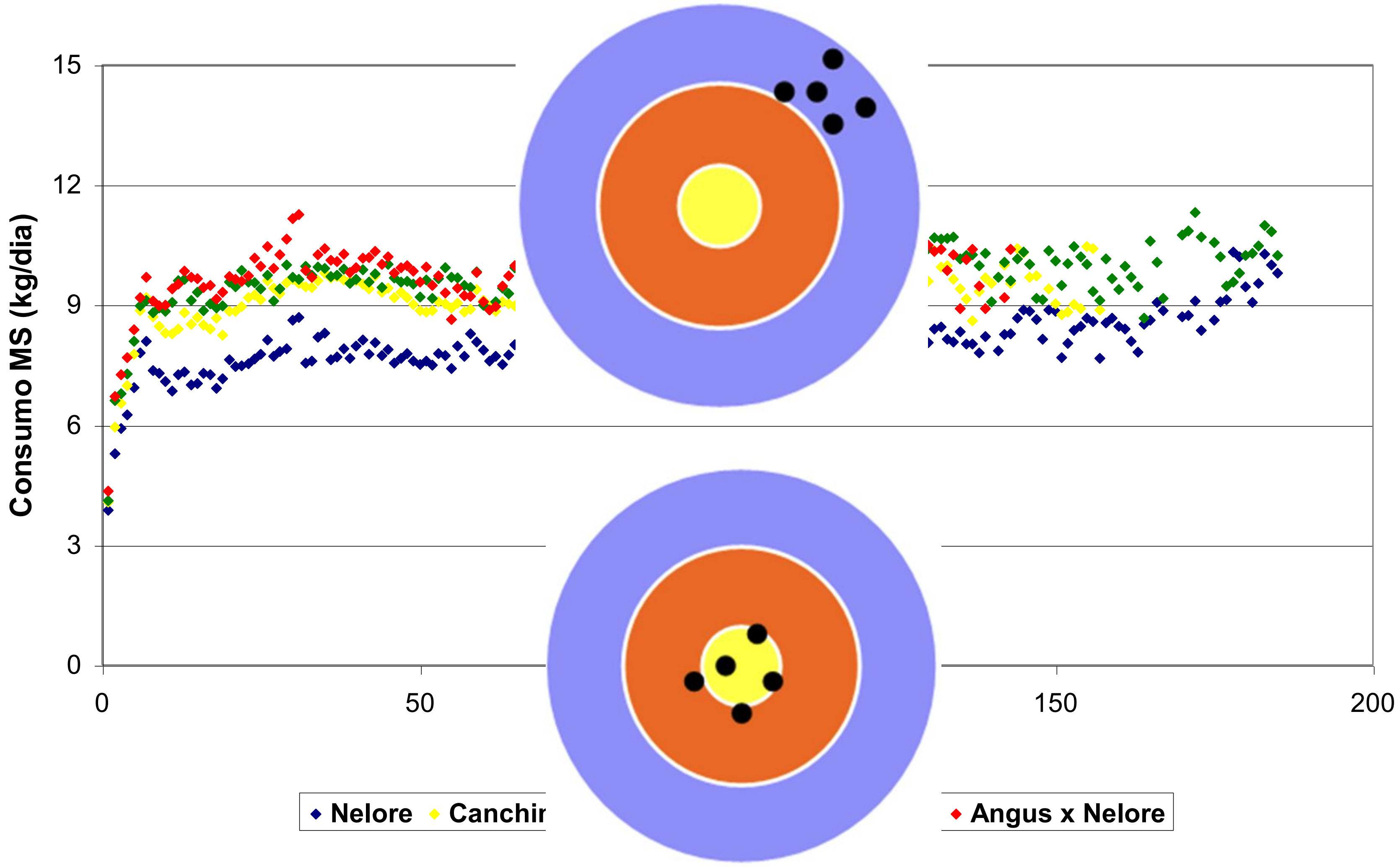


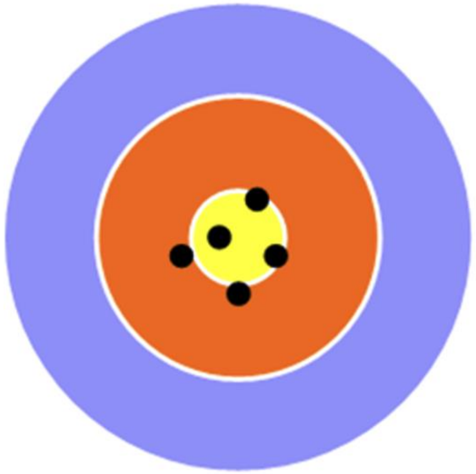




Caetano & Lanna, 2012

Consumo de MS em kg/dia x tempo





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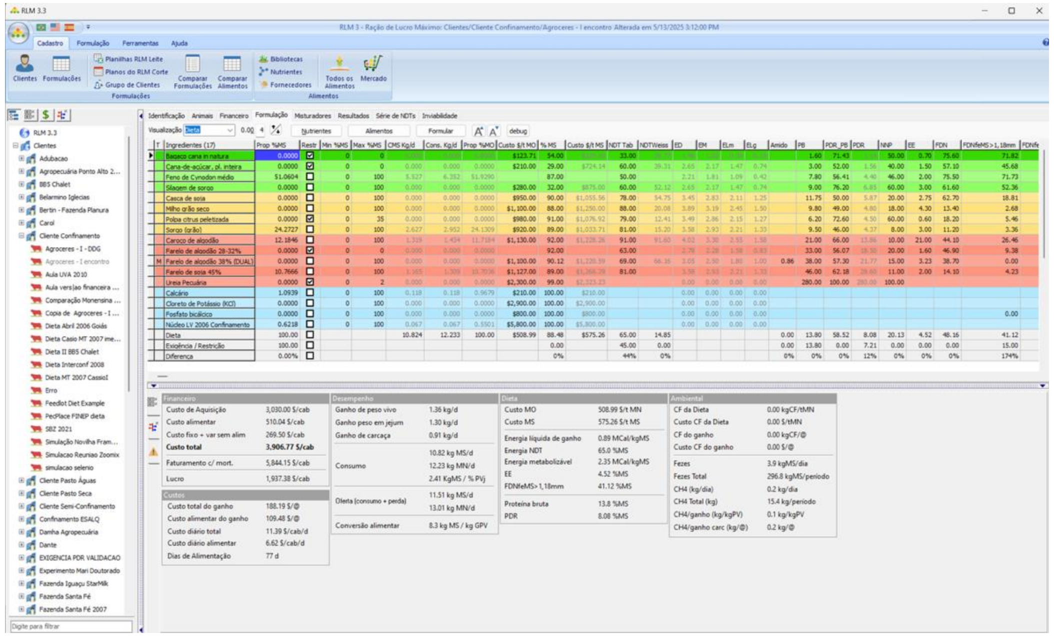
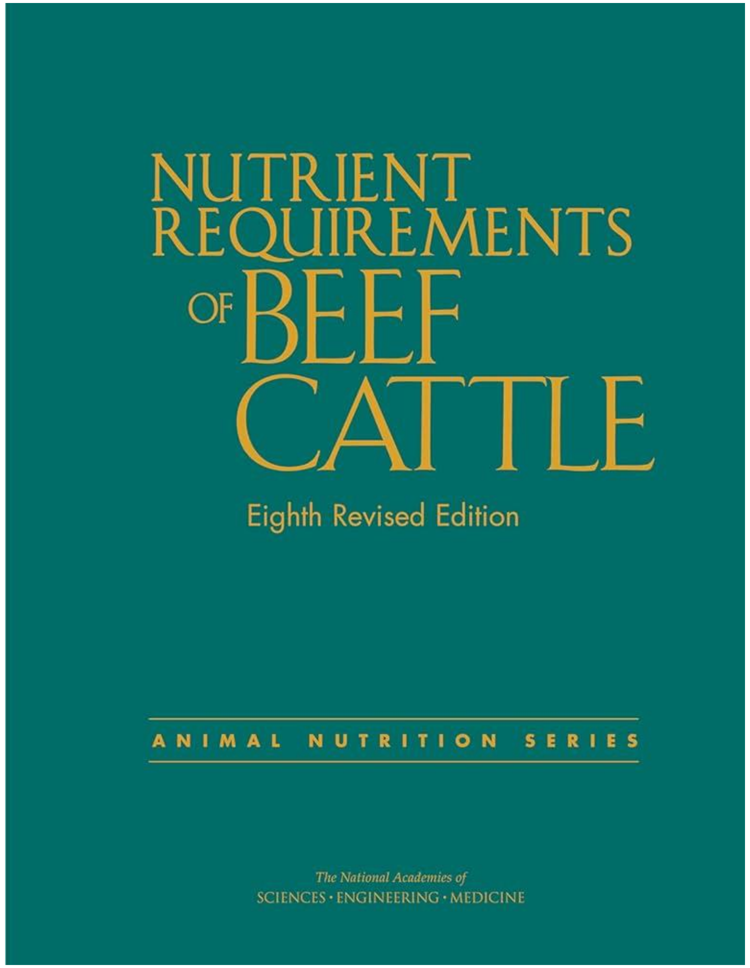


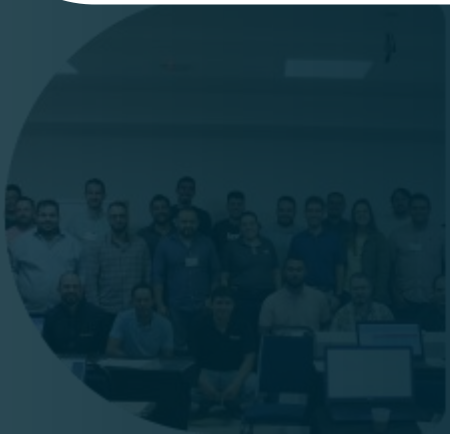




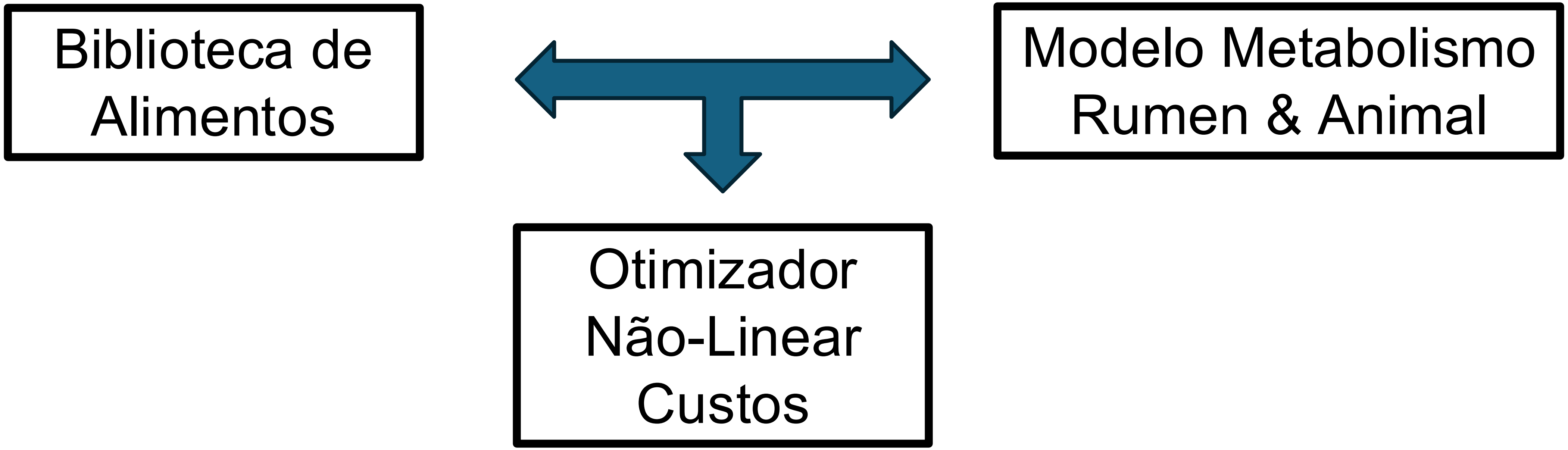

PLATAFORMA MAIS UTILIZADA PRA FORMULAÇÃO DE DIETAS NO BRASIL

RLM
Ração de Lucro Máximo



Os próximos passos?



Principais usuários do RLM

- Pecuaristas de corte e leite
- Confinamentos
- Pecuária com suplementação a pasto
- Fábricas de ração
- Consultores de nutrição bovina
- Representantes comerciais da indústria de insumos pecuários

Ração de Lucro Máximo

Os próximos passos no uso de Algoritmos e Inteligência Artificial

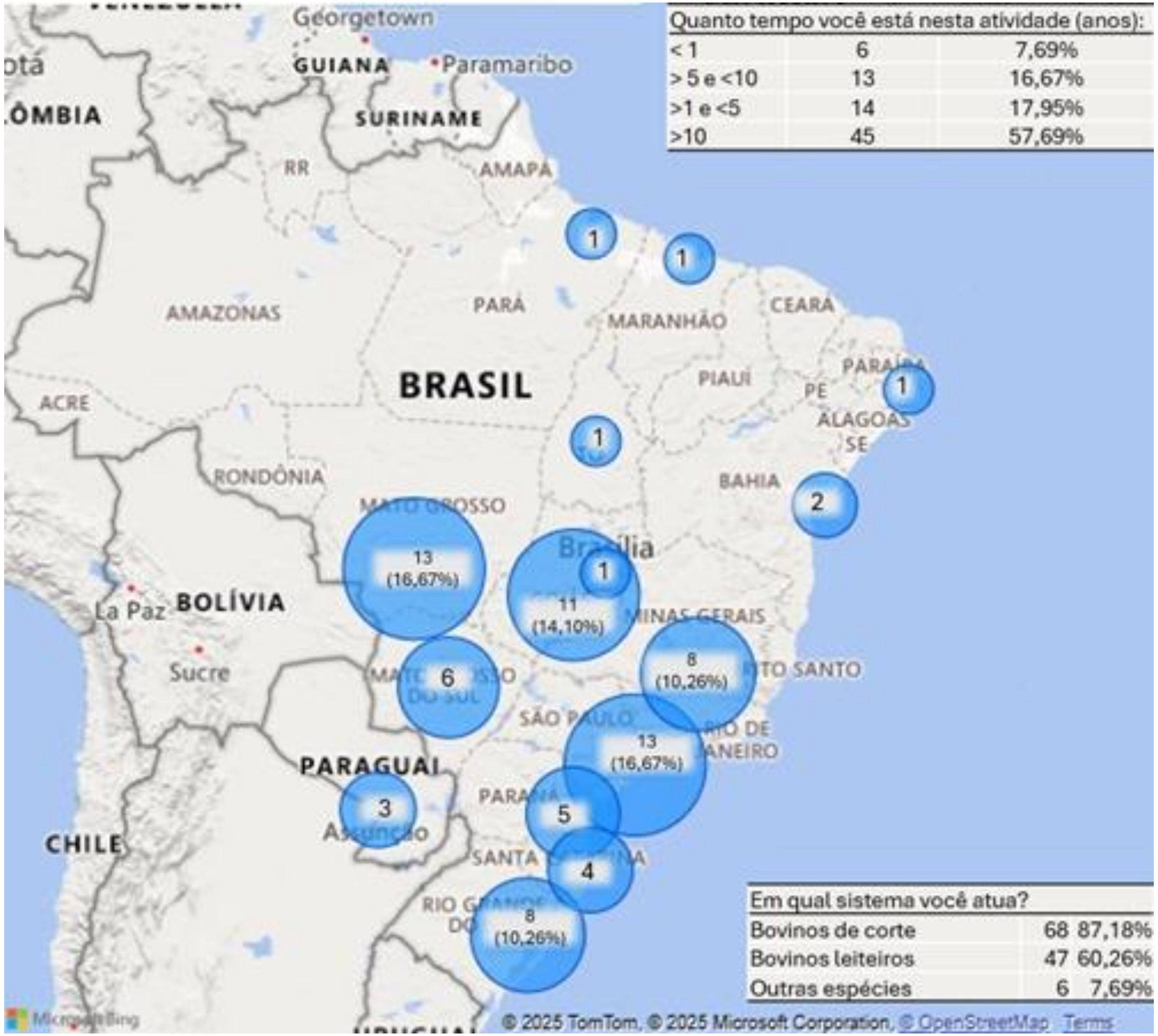
Biblioteca de Alimentos

Modelo Metabolismo Rumen & Animal

Otimizador Não-Linear Custos

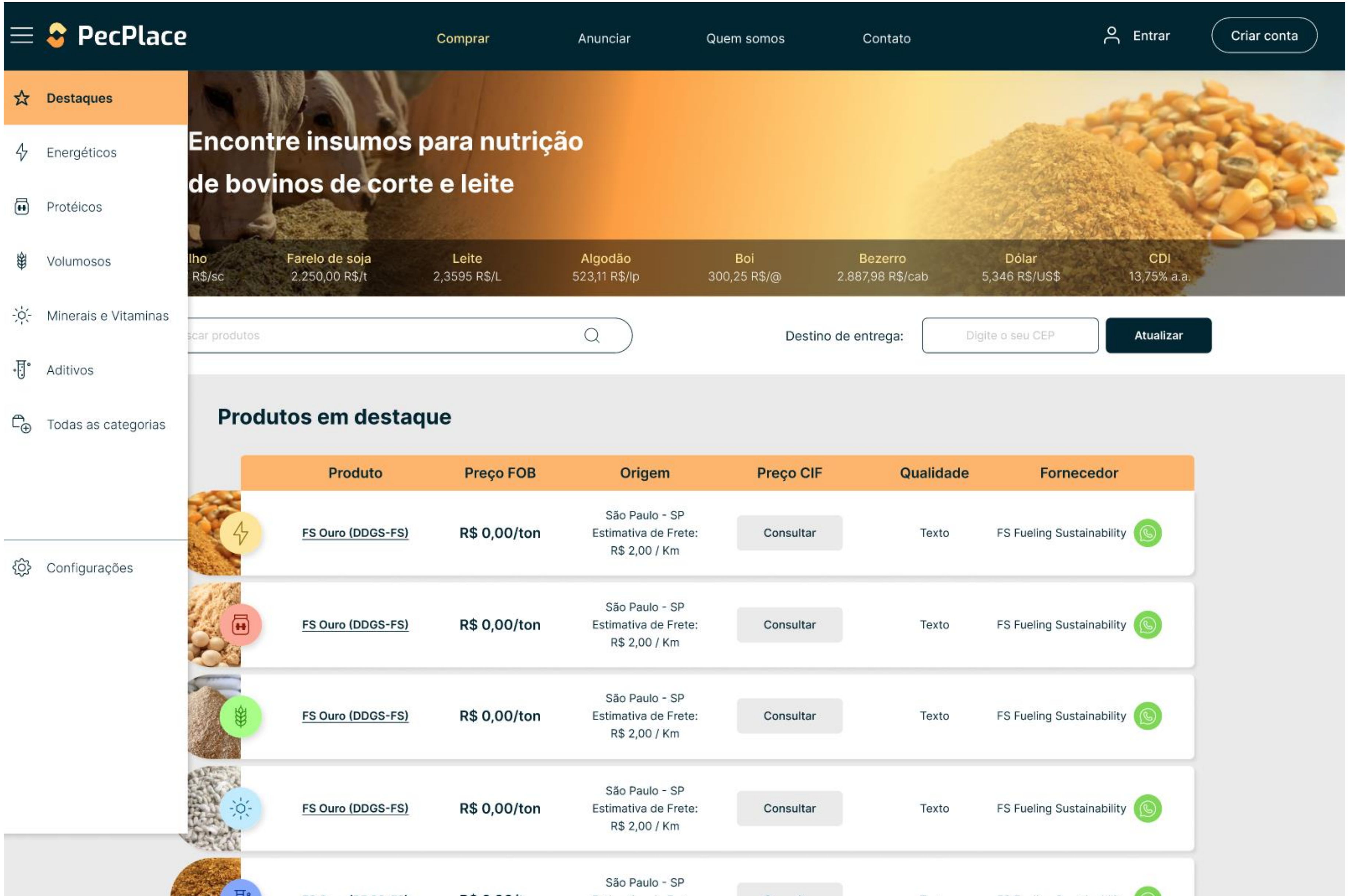
Aquisição e Logísitca dos Ingredientes

Desafios dos insumos



PecPlace

A plataforma única

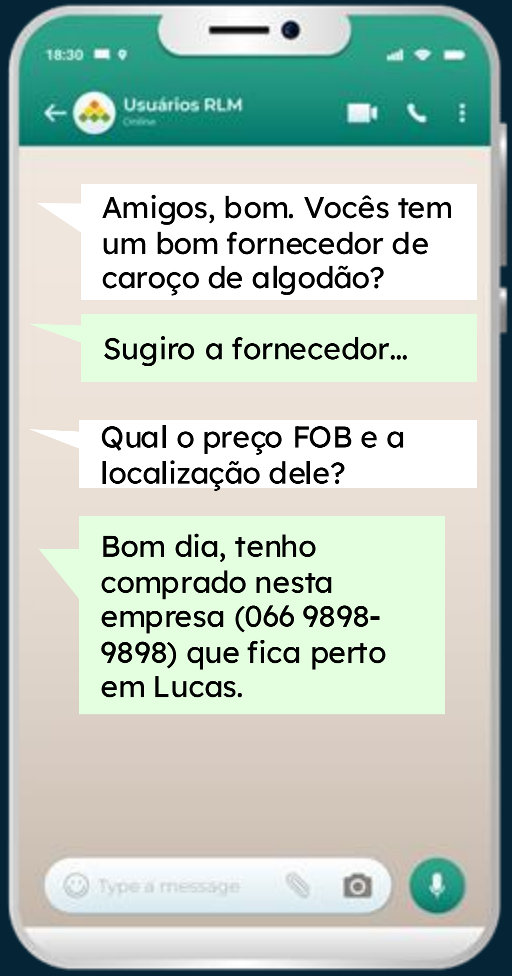


PecPlace

Problema No 1

- Onde adquirir ingredientes para formular???
- Qual o valor para testar na minha dieta???

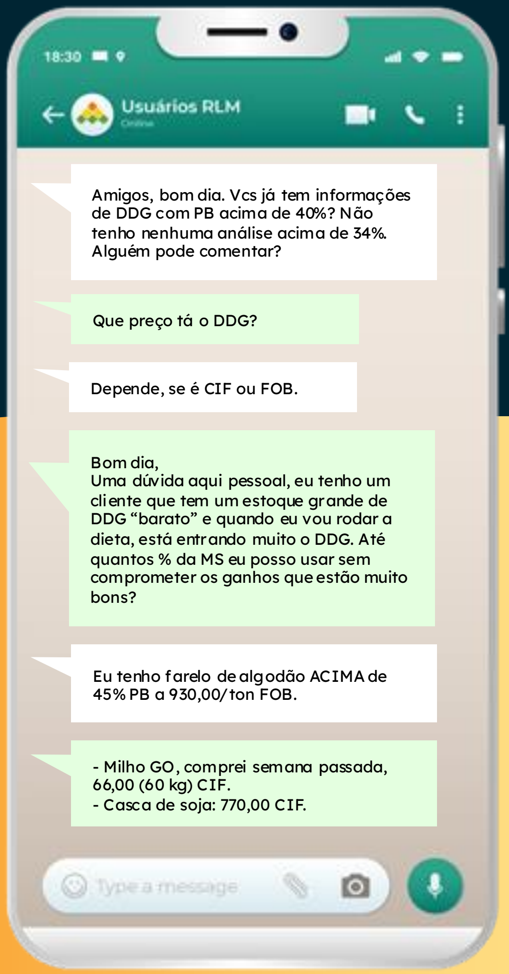
ORIGINAÇÃO!



Problema No2

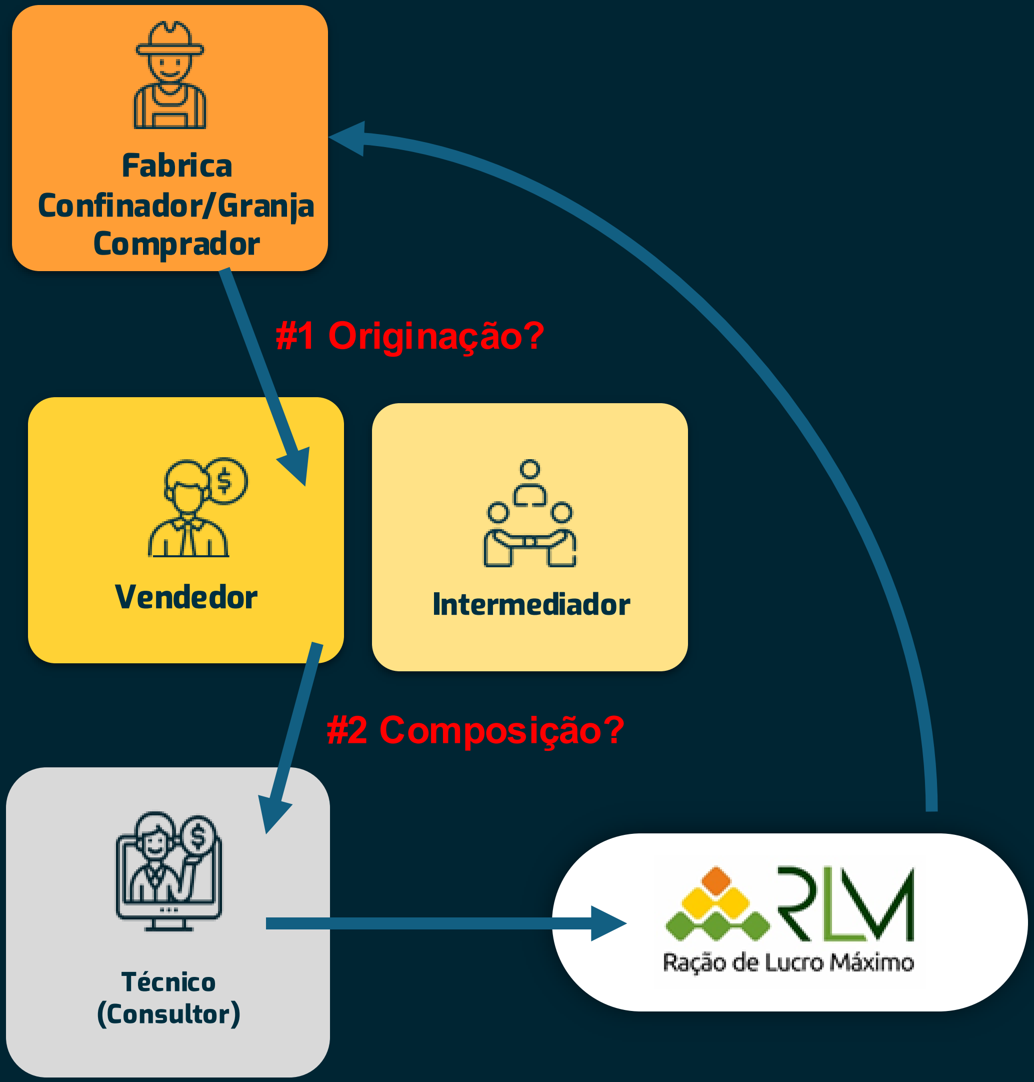
Qual a composição e o contato do vendedor?

INFORMAÇÃO SOBRE QUALIDADE!



- Análises genéricas, similares ou desatualizadas
- Erro na inserção dos dados na simulação

Ecossistema



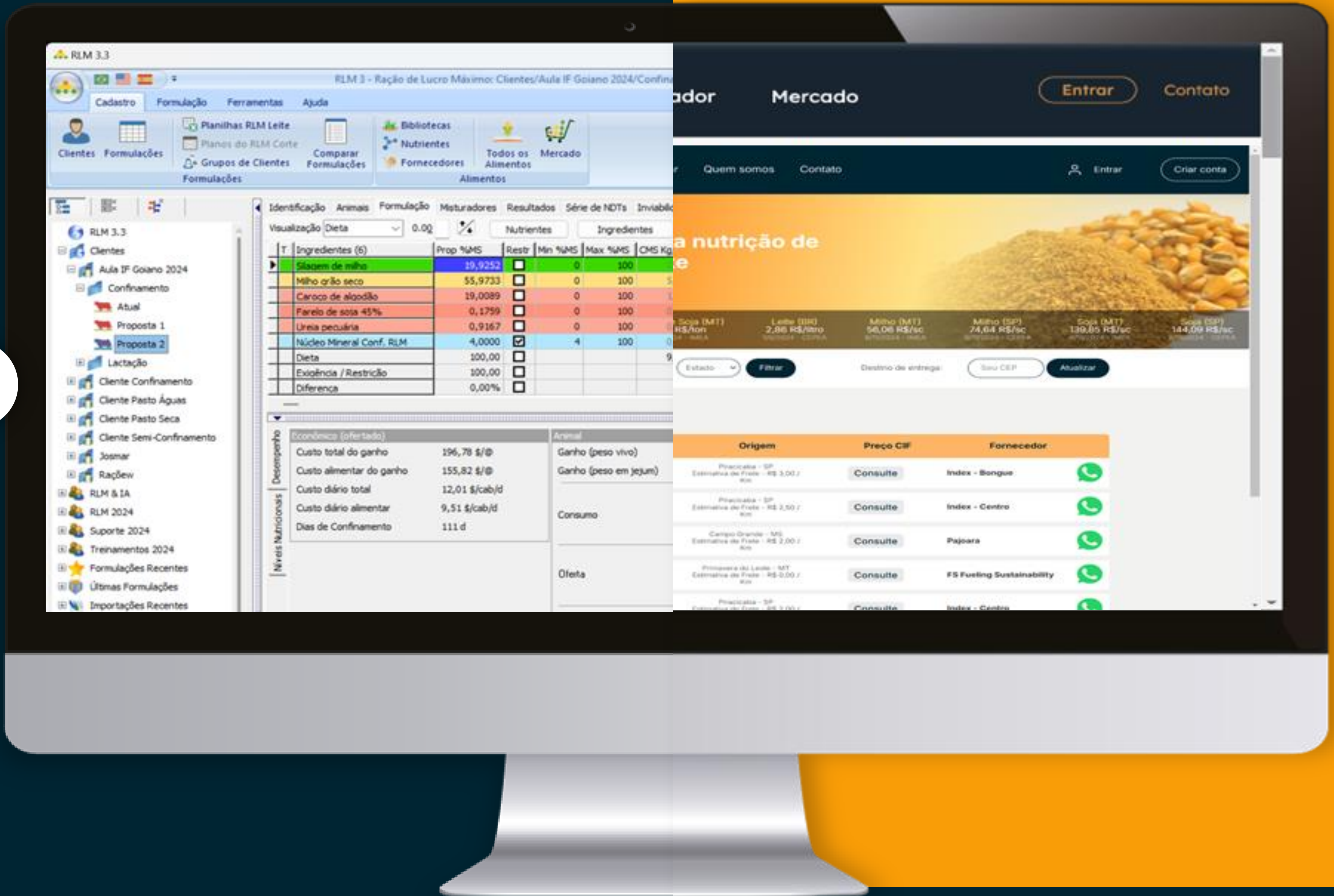
Integração

Dentro do software formulação

Nutricionistas / departamento técnico

Disponível na web

Dept. de compras / Proprietários



RLM

PecPlace

RLM 3.3

RLM 3 - Ração de Lucro Máximo: Clientes/Cliente Confinamento/Agroceres - I encontro Alterada em 5/13/2025 3:12:00 PM

Cadastro | Formulação | Ferramentas | Ajuda

Clientes | Formulações | Planilhas RLM Leite | Planos do RLM Corte | Grupo de Clientes | Comparar Formulações | Comparar Alimentos — Formulações

Bibliotecas | Nutrientes | Fornecedores | Todos os Alimentos | Mercado — Alimentos

Financeiro

Custos	
Aquisição	3,030.00 $/cab
Alimentar	510.04 $/cab
Fixo + var s alim	269.50 $/cab
Financeiro (juros)	97.23 $/cab
Total	3,906.77 $/cab
Faturamento c/ mort.	5,844.15 $/cab
Lucro	**1,937.38 $/cab**

Custos

Custo total ganho	**188.19 $/@**
Custo alim ganho	109.48 $/@
Custo diário total	11.39 $/cab/d
Custo diário alimentar	6.62 $/cab/d
Custo financeiro (juros)	1.26 $/cab/d
Período	77 d

Identificação | Animais | Financeiro | Formulação | Misturadores | Resultados | Série de NDTs | Inviabilidade

Visualização Dieta 0.00 | Nutrientes | Alimentos | Formular | debug

T	Ingredientes (17)	Prop %MS	Restr	Min %MS	Max %MS	CMS Kg/d	Cons. Kg/d	Prop %...	Custo $/t ...	% MS	Custo $/t MS	NDT Tab	NDTWeiss	ED	EM	ELm	ELg	Amido	PB
	Bagaço cana in natura	0.0000	☑	0	0	0.000	0.000	0.0000	$123.71	54.00	$229.10	33.00	26.77	1.46	1.20	0.38	-0.18		1.6
	Cana-de-açúcar, pl. inteira	0.0000	☑	0	0	0.000	0.000	0.0000	$210.00	29.00	$724.14	60.00	39.31	2.65	2.17	1.47	0.74		3.0
	Feno de Cynodon médio	51.0604	☐	0	100	5.527	6.352	51.9290		87.00		50.00		2.21	1.81	1.09	0.42		7.8
	Silagem de sorgo	0.0000	☐	0	100	0.000	0.000	0.0000	$280.00	32.00	$875.00	60.00	52.12	2.65	2.17	1.47	0.74		9.0
	Casca de soja	0.0000	☐	0	100	0.000	0.000	0.0000	$950.00	90.00	$1,055.56	78.00	54.75	3.45	2.83	2.11	1.25		11.7
	Milho grão seco	0.0000	☐	0	100	0.000	0.000	0.0000	$1,100.00	88.00	$1,250.00	88.00	20.08	3.89	3.19	2.45	1.50		9.8
	Polpa citrus peletizada	0.0000	☑	0	35	0.000	0.000	0.0000	$980.00	91.00	$1,076.92	79.00	12.41	3.49	2.86	2.15	1.27		6.2
	Sorgo (grão)	24.2727	☐	0	100	2.627	2.952	24.1309	$920.00	89.00	$1,033.71	81.00	15.20	3.58	2.93	2.21	1.33		9.5
	Caroço de algodão	12.1846	☐	0	100	1.319	1.434	11.7184	$1,130.00	92.00	$1,228.26	91.00	91.60	4.02	3.30	2.55	1.58		21.0
	Farelo de algodão 28-32%	0.0000	☑	0	0	0.000	0.000	0.0000		92.00		63.00		2.78	2.28	1.58	0.83		33.0
M	Farelo de algodão 38% (DUAL	0.0000	☐	0	100	0.000	0.000	0.0000	$1,100.00	90.12	$1,220.59	69.00	66.16	3.05	2.50	1.80	1.00	0.86	38.0
	Farelo de soja 45%	10.7666	☐	0	100	1.165	1.309	10.7036	$1,127.00	89.00	$1,266.29	81.00		3.58	2.93	2.21	1.33		46.0
	Ureia Pecuária	0.0000	☑	0	2	0.000	0.000	0.0000	$2,300.00	99.00	$2,323.23			0.00	0.00	0.00	0.00		280.0
	Calcário	1.0939	☐	0	100	0.118	0.118	0.9679	$210.00	100.00	$210.00			0.00	0.00	0.00	0.00		
	Cloreto de Potássio (KCl)	0.0000	☐	0	100	0.000	0.000	0.0000	$2,900.00	100.00	$2,900.00			0.00	0.00	0.00	0.00		
	Fosfato bicálcico	0.0000	☐	0	100	0.000	0.000	0.0000	$800.00	100.00	$800.00			0.00	0.00	0.00	0.00		
	Núcleo LV 2006 Confinamento	0.6218	☐	0	100	0.067	0.067	0.5501	$5,800.00	100.00	$5,800.00			0.00	0.00	0.00	0.00		
	Dieta	100.00	☐			10.824	12.233	100.00	$508.99	88.48	$575.26	65.00	14.85					0.00	13.8
	Exigência / Restrição	100.00	☐							0.00		45.00	0.00					0.00	13.8

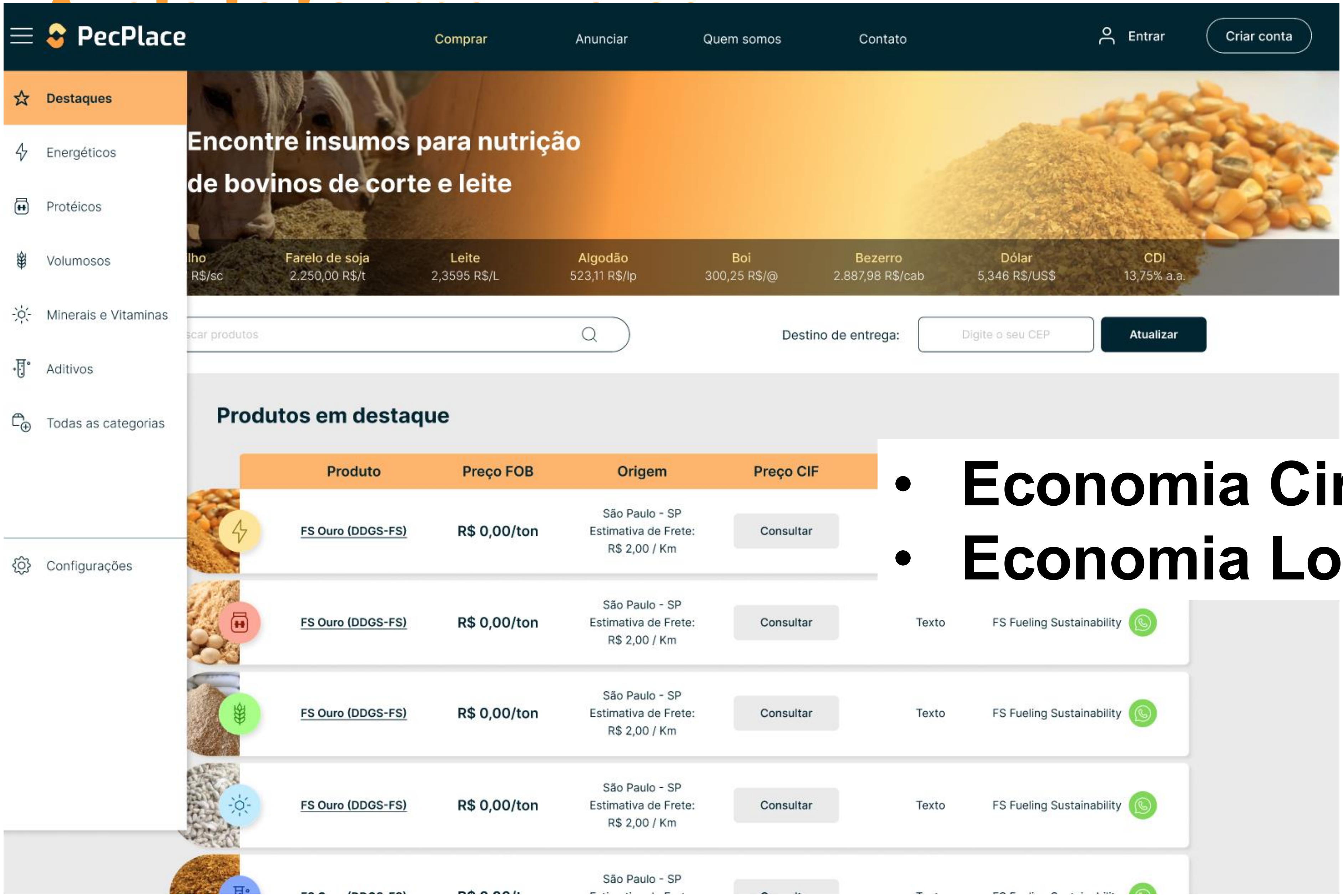
Financeiro	
Custo de Aquisição	3,030.00 $/cab
Custo alimentar	510.04 $/cab
Custo fixo + var sem alim	269.50 $/cab
Custo total	**3,906.77 $/cab**
Faturamento c/ mort.	5,844.15 $/cab
Lucro	1,937.38 $/cab

Custos	
Custo total do ganho	188.19 $/@
Custo alimentar do ganho	109.48 $/@
Custo diário total	11.39 $/cab/d
Custo diário alimentar	6.62 $/cab/d
Dias de Alimentação	77 d

Desempenho	
Ganho de peso vivo	1.36 kg/d
Ganho peso em jejum	1.30 kg/d
Ganho de carcaça	0.91 kg/d
Consumo	10.82 kg MS/d 12.23 kg MN/d 2.41 KgMS / % PVj
Oferta (consumo + perda)	11.51 kg MS/d 13.01 kg MN/d
Conversão alimentar	8.3 kg MS / kg GPV

Dieta	
Custo MO	508.99 $/t MN
Custo MS	575.26 $/t MS
Energia líquida de ganho	0.89 MCal/kgMS
Energia NDT	65.0 %MS
Energia metabolizável	2.35 MCal/kgMS
EE	4.52 %MS
FDNfeMS>1,18mm	41.12 %MS
Proteína bruta	13.8 %MS
PDR	8.08 %MS

Ambiental	
CF da Dieta	0.00 kgCF/tMN
Custo CF da Dieta	0.00 $/tMN
CF do ganho	0.00 kgCF/@
Custo CF do ganho	0.00 $/@
Fezes	3.9 kgMS/dia
Fezes Total	296.8 kgMS/período
CH4 (kg/dia)	0.2 kg/dia
CH4 Total (kg)	15.4 kg/período
CH4/ganho (kg/kgPV)	0.1 kg/kgPV
CH4/ganho carc (kg/@)	0.2 kg/@



- Economia Circular.
- Economia Local.

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Resultado

Universidade Anhembi Morumbi

Ufra UNIVERSIDADE FEDERAL RURAL DA AMAZÔNIA

UNIVERSIDADE FEDERAL DO AMAZONAS IN UNIVERSA SCIENTIA VERITAS

ESALQ

UFG

UFV Universidade Federal de Viçosa

UNIVERSIDADE FEDERAL DO PARÁ

UFMS

unesp UNIVERSIDADE ESTADUAL PAULISTA "JÚLIO DE MESQUITA FILHO" Câmpus de Ilha Solteira

UNIVERSIDADE DE SÃO PAULO FACULDADE DE ZOOTECNIA E ENGENHARIA DE ALIMENTOS FZEA USP *Ciência e inovação da fazenda à mesa*

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