How sustainable are the dairy cattle breeding programs in Brazil?

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Background

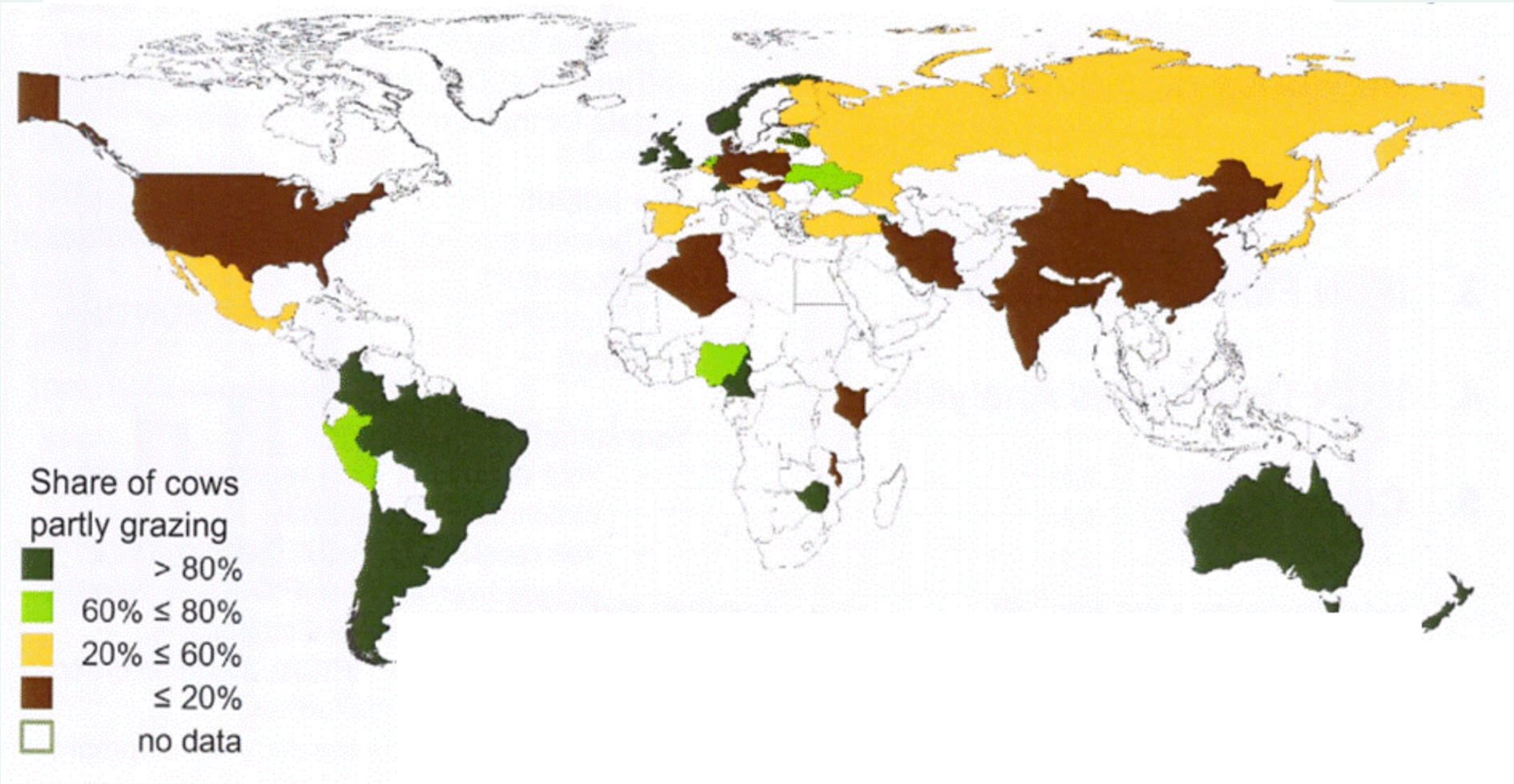
Brazil

- The Brazilian dairy industry is based mainly on pasture-oriented production systems;
- Dual purpose systems in the tropical part, utilizing *B. taurus* x *B. indicus* hybrid animals, mostly Holstein/Gir;
- Cows are milked with restricted suckling of calves;
- Average herd size: 80 cows;
- About 18.0 million dairy cows (1,921 farms);

How importante is the dairy sector in Brazil?

- Milk is produced in every county in Brazil
- 4 million jobs (directly and indirectly)
- Gross sale: US$ 7.5 billion
- Turnover: US$ 18 billion
- Around 1 percent of the country's Gross Domestic Product (GDP)

Pasture based-feeding



Source: IFCN (2017)

Production Statistics

Dairy, Milk, Fluid Brazil	2017		2018		2019		
	Market Year Begin: Jan 2017		Market Year Begin: Jan 2018		Market Year Begin: Jan 2019		
	USDA Official	New Post	USDA Official	New Post	USDA Official	New Post	
Cows In Milk	17,650	16,262	17,950	16,215		16,300	(1000 HEAD)
Cows Milk Production	23,550	23,624	23,980	22,659		23,150	(1000 MT)
Other Milk Production	3,337	3,142	3,270	3,003		3,060	(1000 MT)
Total Production	26,887	26,766	27,250	25,662	0	26,210	(1000 MT)

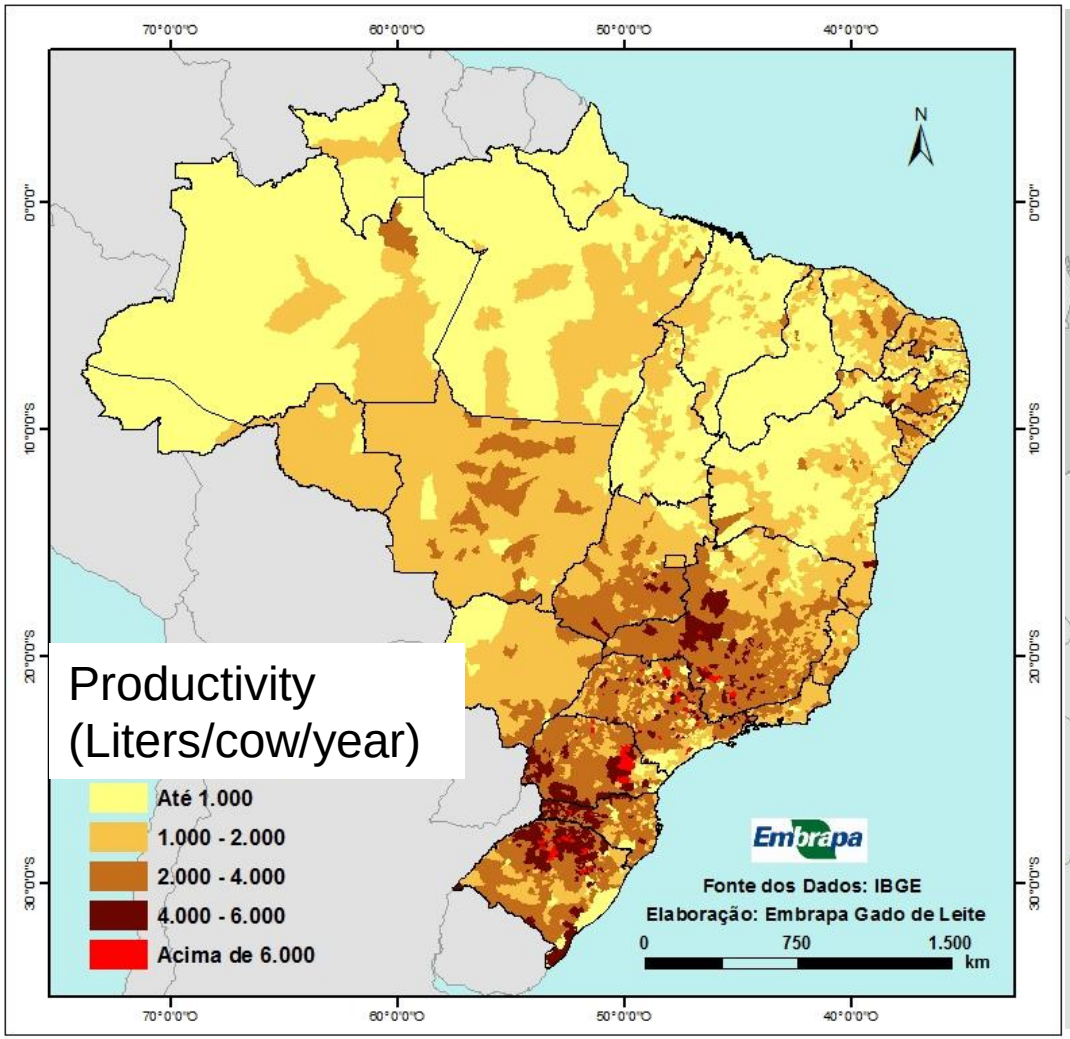
Source: USDA (2018)

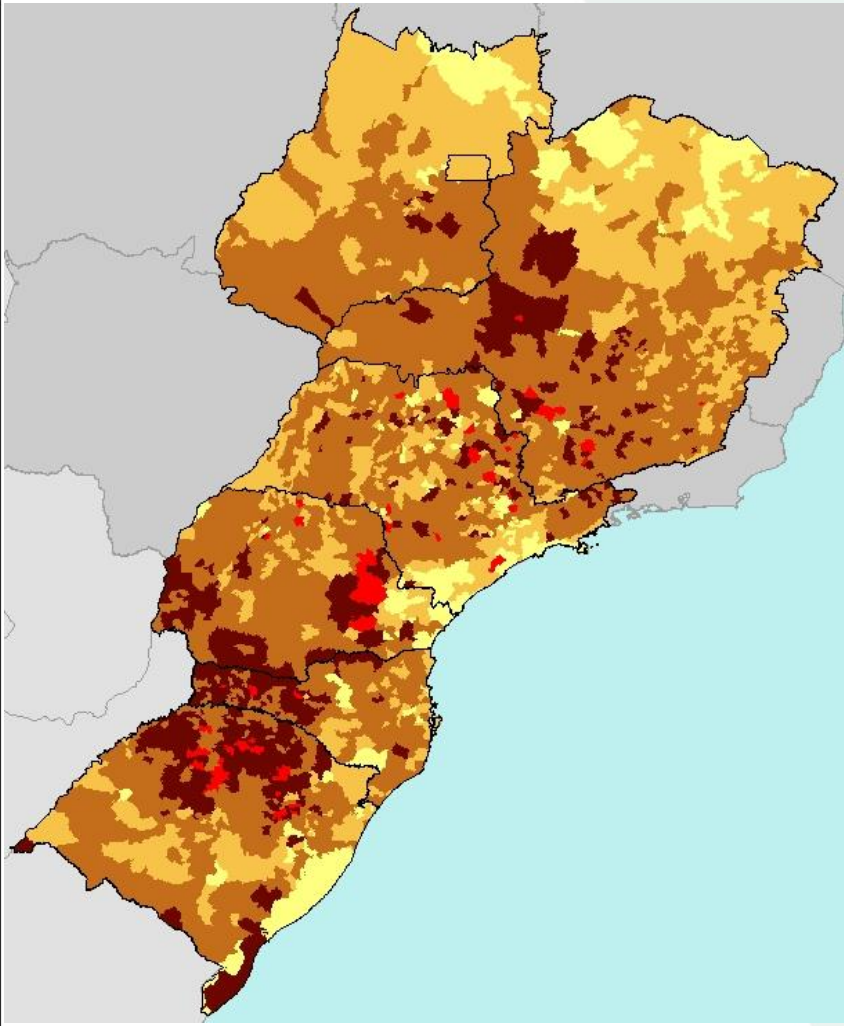
Milk Production by Region

- The Southeast and South regions of Brazil are the main milk producing areas;
- Minas Gerais state is the largest milk producer (25.6% of the total milk production in 2017);
- Rio Grande do Sul state accounted for 13.2%, and Paraná accounted for 11.7 % in 2017.
- Average milk production in Brazil was 1,695 liters/cow/year in 2017

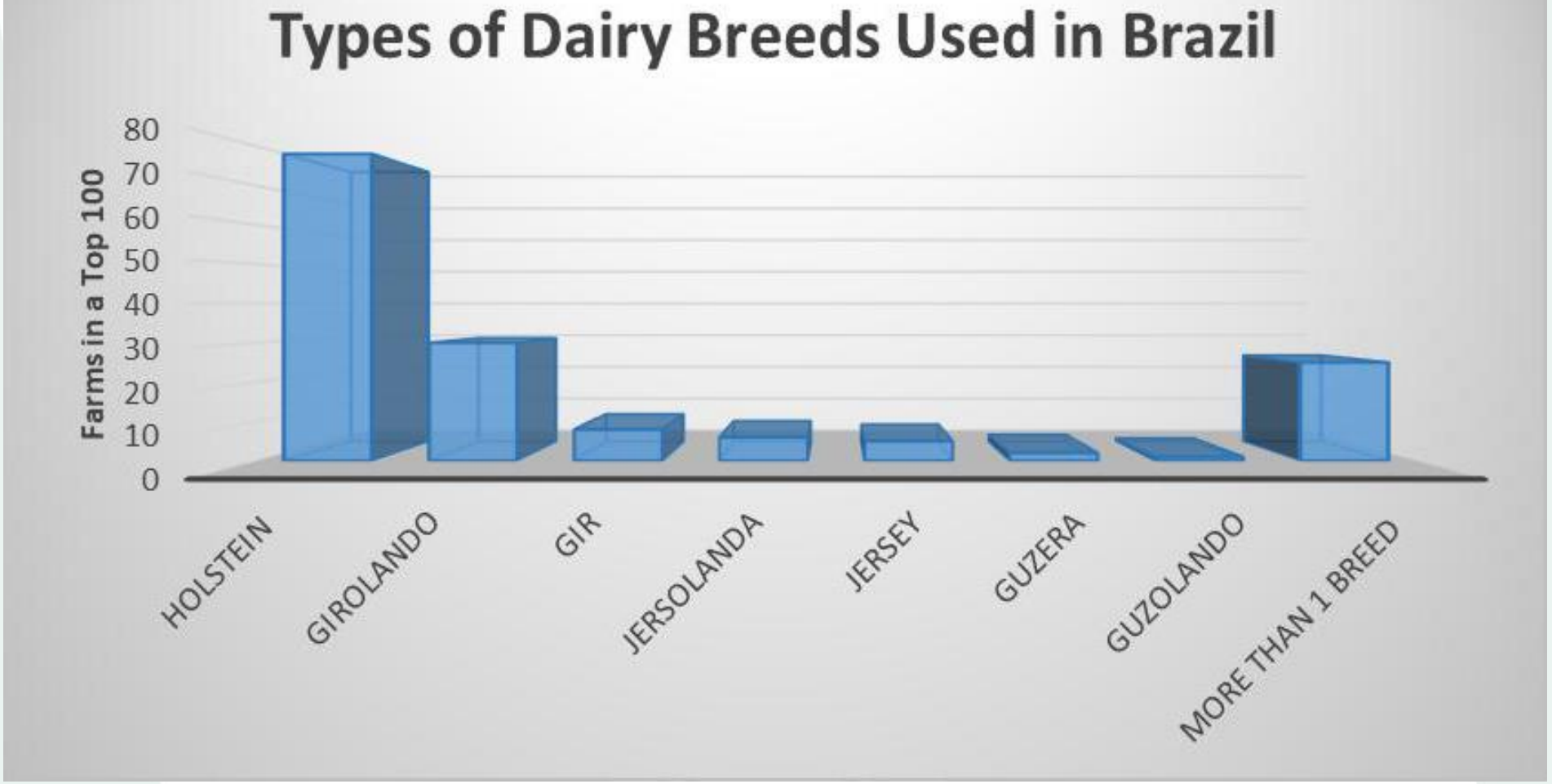
Source: USDA/IBGE (2018)

Brazil | Productivity of Dairy Cows





Source: IBGE



- There is an association of the *B. taurus* grade with the input level of the production system;

-Low-input, smaller farms, use a higher proportion of the more resilient (B.indicus), low *B. taurus* grade cows;

-Larger farms use more of the higher yielding, higher *B. taurus* grades

Types of Dairy Breeds Used in Brazil

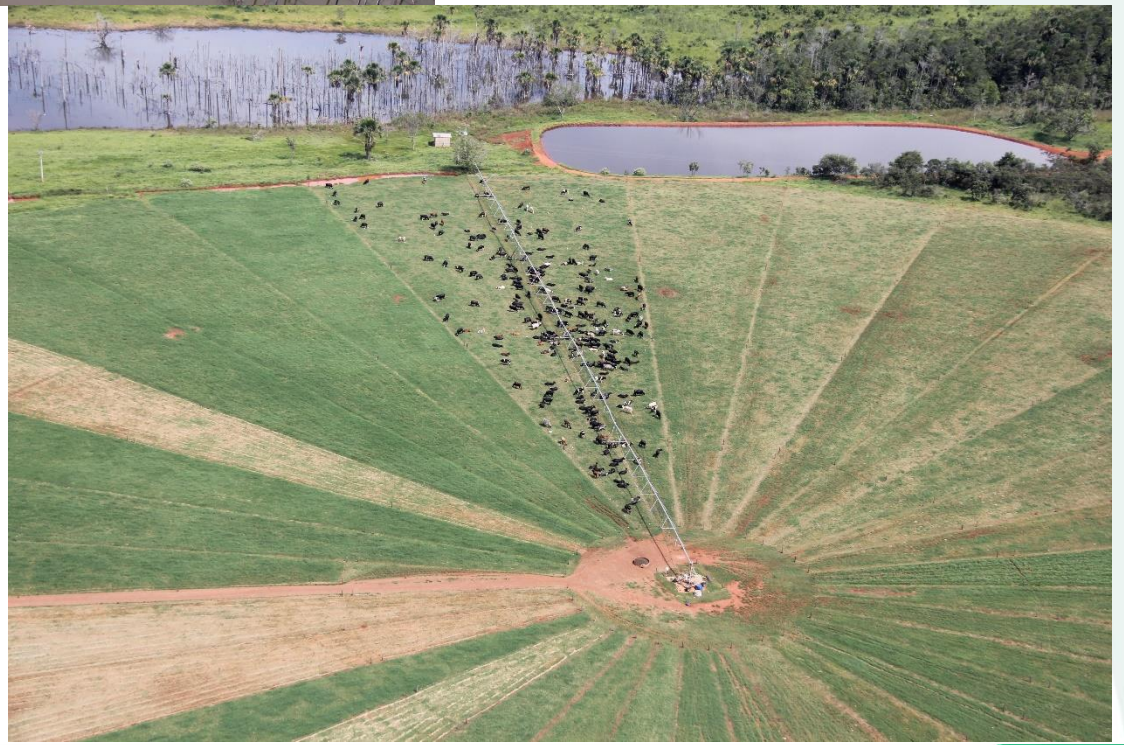
- There are no cattle census data by breed, so information on this topic comes from specific sample surveys;
- In farms affiliated to the main dairy processor in the State of Minas Gerais showed 89% having *B. taurus x B.indicus* genetics (Madalena et al., 2012);

Production Systems in Brazil

- Irrigated intensive rotational grazing;
- Extensive grazing/limited supplementation;
- Semi-confinement;
- Full confinement.

Production Systems in Brazil

Irrigated intensive rotational grazing - Not commonly used, but is being promoted by a government-supported program for small producers. Promotes irrigated pasture management and good herd management and accurate record-keeping;



Center Pivot Irrigation System


Fazenda
SANTA LUZIA


ZznPeres.com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Production Systems in Brazil

Extensive grazing/limited supplementation

- In this system, the ration consists almost entirely of grazed pasture grass
- Herds are typically in the 30–70 cow size range and consist mostly of cross-bred animals;
- Cows in these herds are usually hand-milked in parlors.

- Hot and humid climate

- Hot and humid climate


1ª PROVA DE PRÉ-SELEÇÃO DE TOUROS
PARA O TESTE DE PROGÊNIE
ABCGIL/EMBRAPA

Production Systems in Brazil

Semi-confinement

- Herd size ranges from 70-200 cows and use green-chopped forages (mostly sugar cane), silage, and concentrates year-round to supplement grazed grass;
- Cows are typically 50-50 crossbred and artificial insemination is common.

Production Systems in Brazil

Full confinement

- This system is comparable to parlor-freestall dairy operations in The US;

- Typically, purebred Holsteins are fed conserved forages, and concentrates in freestall barns.

Source: https://sistemafaep.org.br/parana-consolida-seu-lugar-como-segundo-maior-produtor-de-leite-do-brasil

Source: https://globoplay.globo.com/v/3844834/

Brazilian Animal Breeding Programs in *Bos indicus* and Girolando

1983:
National Program for Improvement of Dairy Gyr

1994:
National Program for Improvement of Guzera

1997:
National Program for Improvement of Girolando

2010:
National Program for Improvement of Sindhi

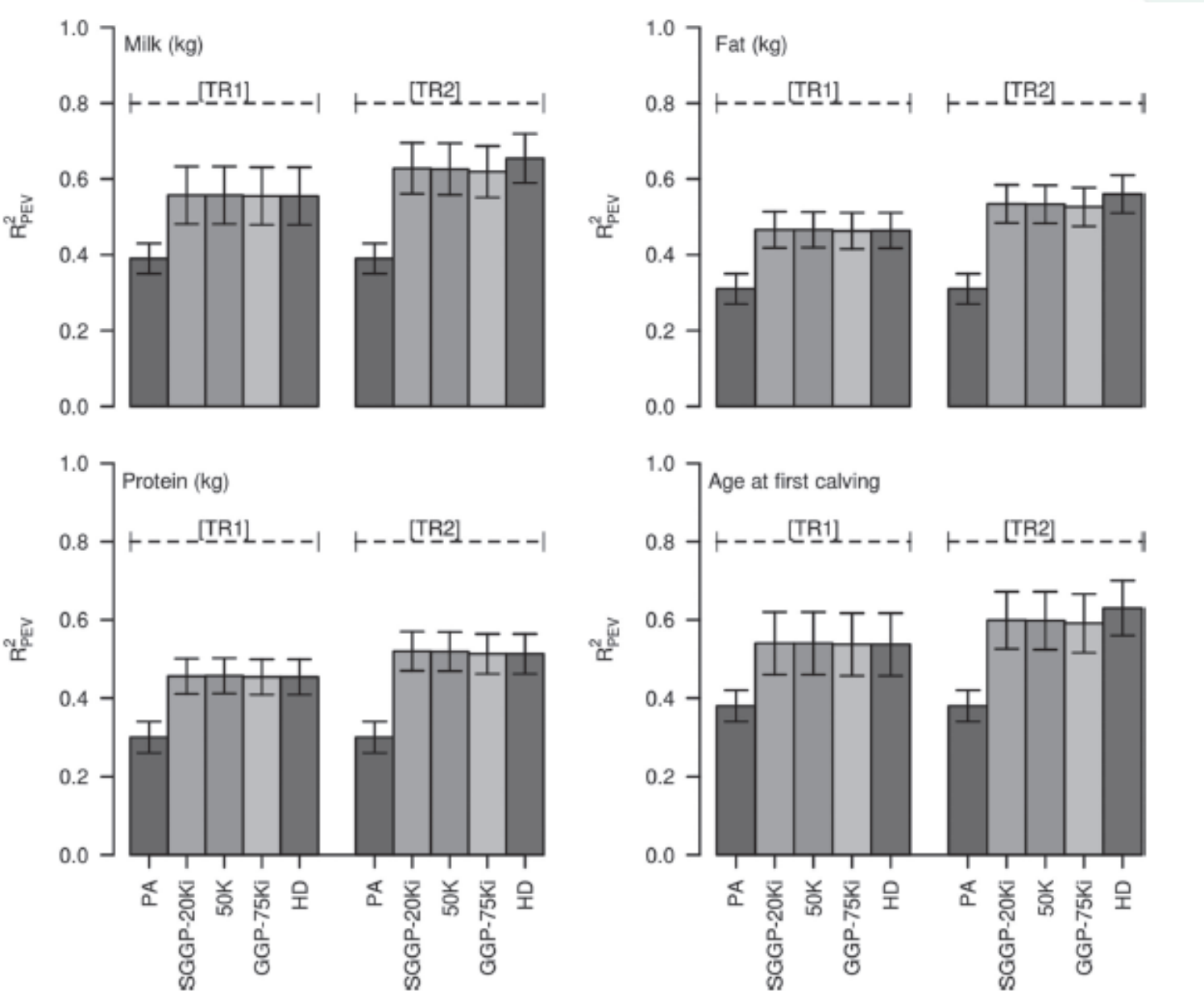
Genomic Selection in Brazilian Dairy Cattle

Genomic Selection in Brazilian Dairy Cattle

- ✓ Grant: US$ 600,000.00
- ✓ Genotypes:
  - **Gir:** 620 bulls (HD), 1,676 cows (SNP50K) and 7,370 bulls and cows (Neogen Z-chip 30K)
  - **Girolando:** 2,000 bulls (HD) and 6,751 cows (Z2L, Z2M, SNP50K and HD)
    - Collaboration with private companies (Zoetis and CRV)

Results – Genomic Selection in Gyr

Average reliability using GBLUP



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Accuracy of genomic predictions in Gyr (*Bos indicus*) dairy cattle

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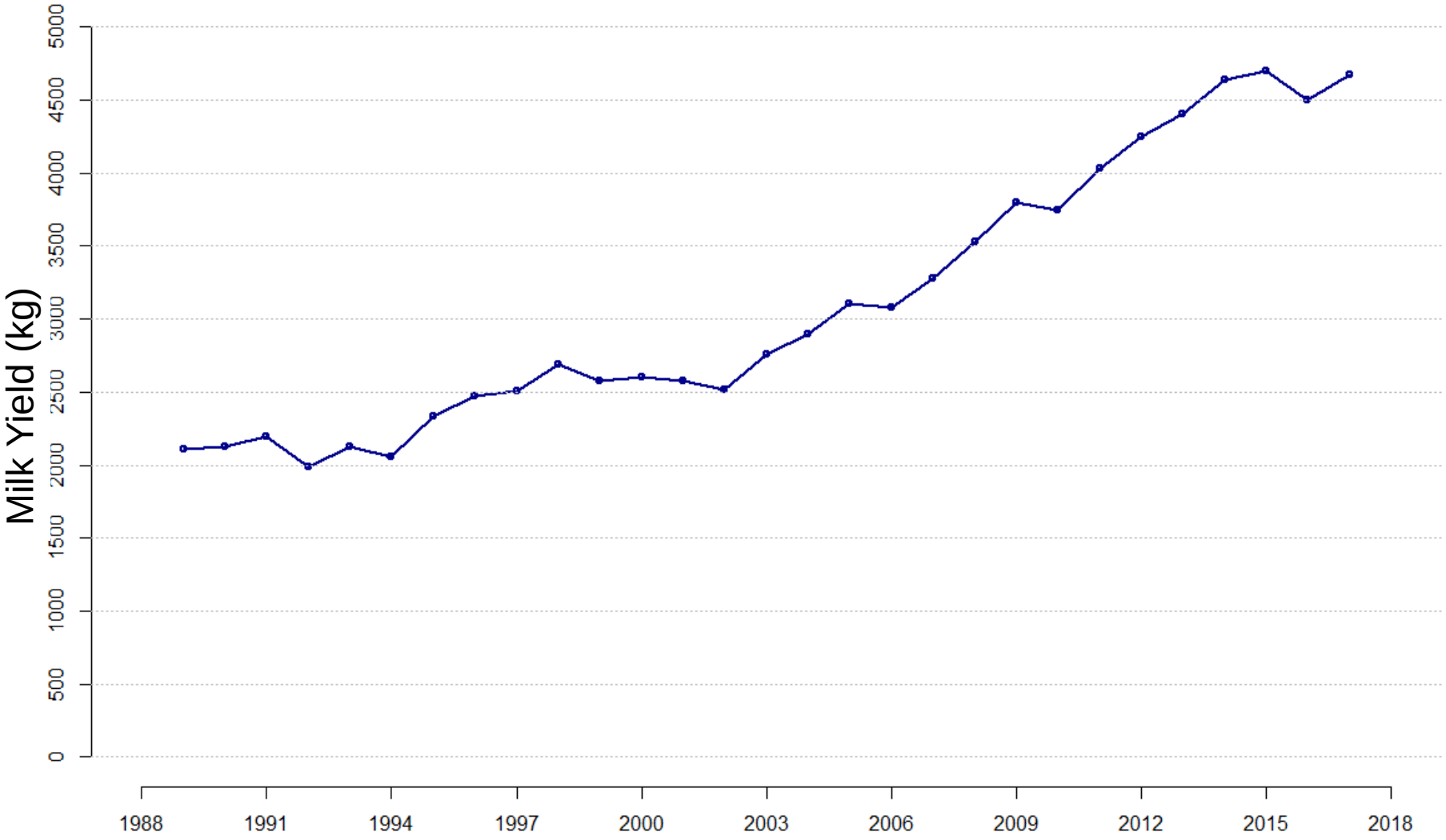
Brazilian farmers are already using GS for picking the Gir bulls to progeny testing!

Milk (kg) up to 305 days, per year of calving, in Gir



Source:Embrapa Dairy Cattle (2019)

Milk, fat and protein yield, lactation length, calving interval and age at first calving of Gir breed

Milk Yield (305 days)	4,535 kg
Lactation Length	290 d
Fat Yield (305 days)	139.6 kg
Fat Content	4.24%
Protein Yield:	113.2 kg
Protein Content:	3.46%
Total Solids (305 days):	431.2 kg
Age at First Calving	40 m
Calving Interval	15 m

Source:Embrapa Dairy Cattle (2018)

Sire and Cow Summaries

SNP Identification (zebu specific)

PLOS ONE

RESEARCH ARTICLE

Single nucleotide variants and InDels identified from whole-genome re-sequencing of Guzerat, Gyr, Girolando and Holstein cattle breeds

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Check for updates

Tropical Dairy Project

Application of Genomic Selection in Girolando Cattle

Girolando Genomic Evaluation - Objectives

- Develop genomic evaluation for the Girolando breed based on Single Step Approach.
- Investigate impact of genomic information on breeding value predictions and reliabilities of animals of different breed compositions.
- Estimate the breed composition using genomics;
- Conduct validation study to show predictive power of genotypes for young animals.

RESULTS
COWS

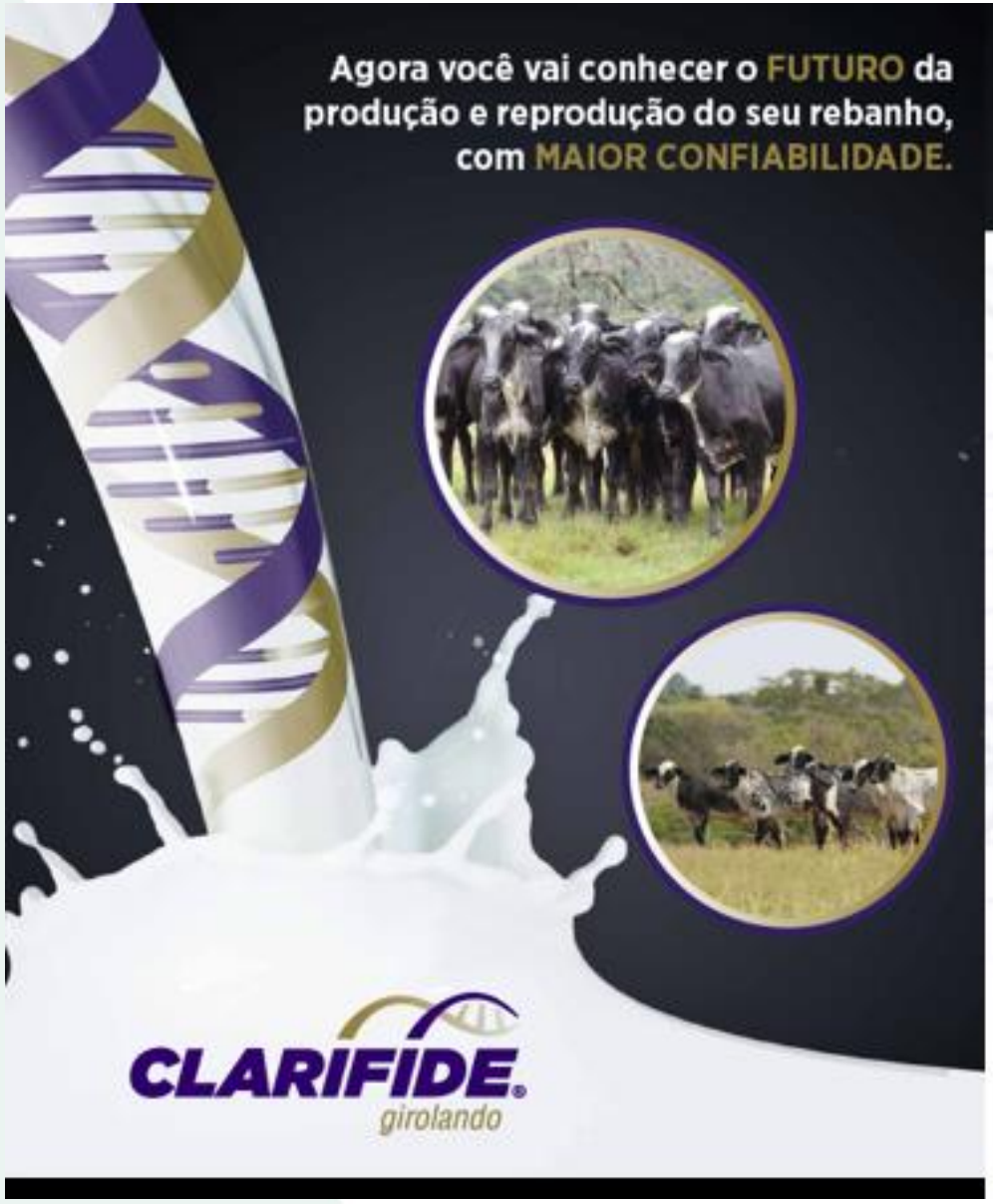
Results #1 – Young Animals

EBVs and reliabilities from genomic and traditional evaluation

Trait	PA (REL)	gEBV (REL)	Gain
Milk	18%	45%	27%
AFC	18%	46%	28%
CI	8%	22%	14%

Milk yield, lactation length, calving interval and age at first calving of Girolando breed

Calving year	Milk yield (kg)		Lactation length (days)	Calving Interval (days)	Age at First Calving (days)
	305 days	Total			
2000	3,599 ± 1,989	3,897 ± 2,480	249 ± 111	424 ± 84	993 ± 174
2001	3,497 ± 1,887	3,721 ± 2,199	242 ± 110	427 ± 92	1,024 ± 190
2002	3,429 ± 1,767	3,640 ± 2,054	244 ± 108	421 ± 87	1,027 ± 187
2003	3,510 ± 1,797	3,747 ± 2,075	252 ± 109	428 ± 90	1,017 ± 169
2004	3,619 ± 1,878	3,872 ± 2,176	251 ± 112	434 ± 97	1,050 ± 181
2005	3,582 ± 1,924	3,854 ± 2,281	248 ± 112	444 ± 97	1,102 ± 191
2006	3,768 ± 1,958	4,084 ± 2,349	257 ± 110	443 ± 92	1,100 ± 171
2007	4,110 ± 2,101	4,432 ± 2,520	265 ± 98	450 ± 96	1,129 ± 185
2008	4,362 ± 2,149	4,814 ± 2,754	281 ± 102	441 ± 93	1,138 ± 185
2009	4,467 ± 2,311	4,932 ± 2,923	272 ± 112	426 ± 87	1,110 ± 186
2010	4,499 ± 2,452	4,977 ± 3,128	259 ± 120	426 ± 93	1,084 ± 194
2011	4,829 ± 2,416	5,419 ± 3,105	275 ± 126	429 ± 97	1,045 ± 207
2012	4,919 ± 2,372	5,587 ± 3,133	280 ± 127	438 ± 102	1,056 ± 204
2013	5,146 ± 2,489	5,805 ± 3,286	275 ± 120	442 ± 100	1,056 ± 210
2014	5,340 ± 2,541	6,046 ± 3,342	277 ± 125	439 ± 105	1,070 ± 232
2015	5,278 ± 2,421	6,014 ± 3,283	281 ± 125	440 ± 103	1,055 ± 232
2016[1]	5,445 ± 2,577	6,166 ± 3,398	277 ± 121	439 ± 105	998 ± 191
2017[1, 2]	4,687 ± 2,829	4,903 ± 3,095	210 ± 113	445 ± 106	1,007 ± 189
Geral	**4,820 ± 2,485**	**5,378 ± 3,184**	**267 ± 121**	**437 ± 100**	**1,052 ± 209**



CLARIFIDE. girolando

Chegou o serviço de avaliação genética mais esperado do mercado.

Ele permite **FACILMENTE** a seleção dos seus melhores animais, com uma confiabilidade superior aos dos métodos tradicionais baseados somente em fenótipo, pedigree ou ambos.

CONHEÇA O POTENCIAL GENÉTICO DE SEUS ANIMAIS EM RELAÇÃO À:

- Produção de Leite;
- Idade ao 1º parto;
- Intervalo de partos.

ALÉM DE:

- Paternidade*
- Avô Materno*
- Beta Caseína A2**
- Beta Lactoglobulina
- Kappa Caseína I e II

Teste para a seguintes Doenças Genéticas:

- BLAD
- DUMPS
- CVM*
- Brachyspina*

DIVERSAS INFORMAÇÕES apresentadas com ALTA CONFIABILIDADE.

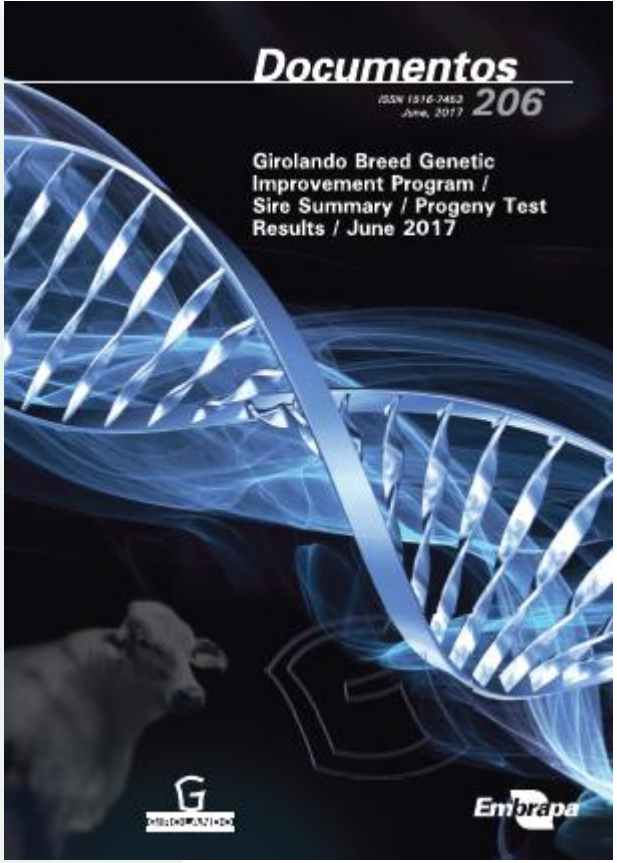
Desenvolvido no Brasil pela equipe de pesquisadores da EMBRAPA Gado de Leite, utilizando informações coletadas pela Associação Brasileira dos Criadores de Girolando e com apoio da Zoetis e CRV Lagoa.

CLARIFIDE. girolando a maneira mais **FÁCIL, RÁPIDA e CONFIÁVEL** para você selecionar:

- Doadoras;
- Novilhas de reposição;
- Fêmeas para descarte.

Enfim, a ferramenta que faltava para criar a estratégia correta, para aumentar a rentabilidade de sua atividade.

GIROLANDO Embrapa CRV Lagoa zoetis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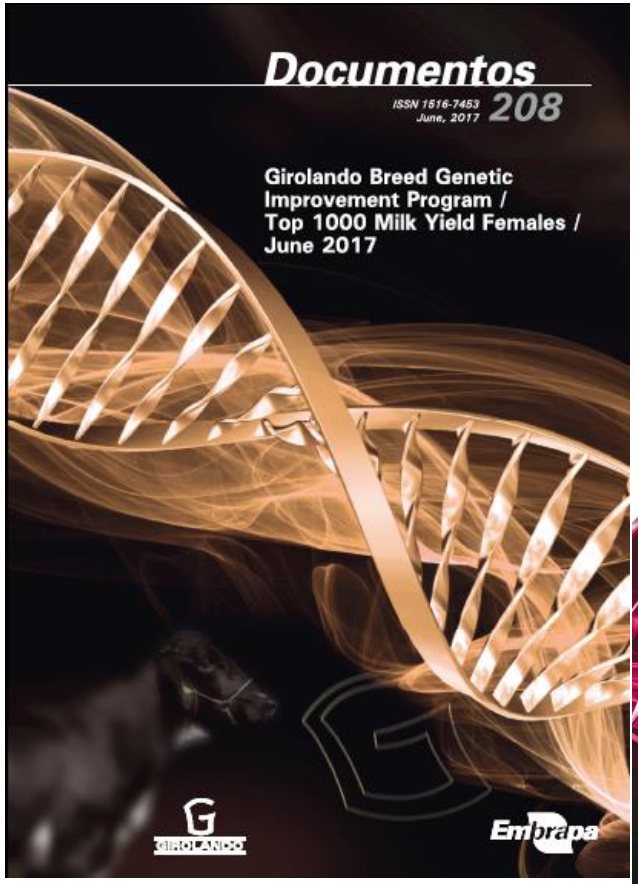
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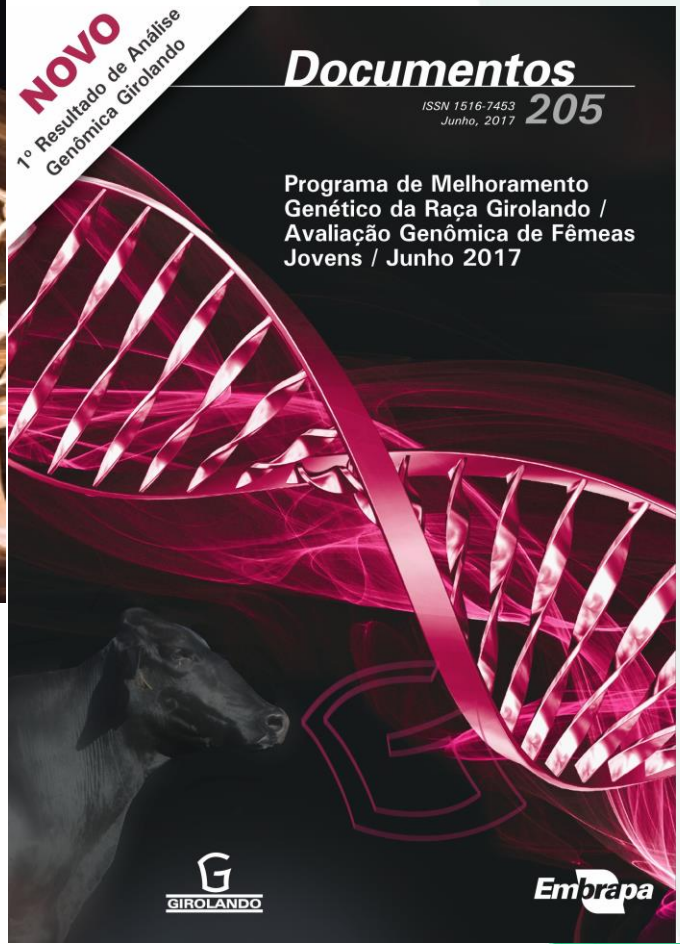
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Conclusions

- Pasture based genetics

- ✓ Viable progeny testing schemes in Brazil for both Girolando and Gir breeds
- ✓ New testing schemes based on genomics
- ✓ Sourcing genetics worldwide to complement Brazilian genetics (Holstein => Girolando)
- ✓ Increasing levels of inbreeding from selection (Gir breed)

Thank you!

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